MORAL AND ETHICAL ISSUES

relating to

NUCLEAR ENERGY GENERATION

Proceedings of a Seminar

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Canadian Nuclear Association
111 Elizabeth St., 11th Floor, Toronto, Ont., Canada M5G 1P7

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Introduction

Recently, public debate has focused upon moral issues common to all forms of energy production. As part of this debate, issues related to the morality of nuclear energy generation have gained increasing attention. For example, both Ontario's Royal Commission on Electric Power Planning and Saskatchewan's Cluff Lake Board of Inquiry recognized the importance of ethical considerations in choosing policy. Similarly, a great amount of attention was focused on these issues at the prominent World Council of Churches Conference on "Faith, Science and the Future" at the Massachusetts Institute of Technology.

In spite of admirable attempts to resolve these issues, there are few indications we are getting closer to an understanding of the ethical dimensions of the arguments. Often, this understanding is hindered because participants in the debate have firmly entrenched moral perspectives on nuclear power, yet may not have worked through the ethical considerations in a rigorous, disciplined manner. This situation results in adversaries arguing about the morality of solutions without having reached agreement about the nature of the questions.

From another perspective, it is difficult to obtain agreement among both religious and secular experts. On the one hand, theologians and philosophers would seem to lack an adequately encompassing ethic for addressing contemporary scientific and technological issues and, tend to have only a limited understanding of the technical considerations. On the other hand, an equal hinderance exists for apologists of nuclear power because those persons from the scientific and engineering professions may be familiar with the technical considerations, but few command a satisfactory method of analyzing and resolving ethical problems.

Even when the ethical considerations are addressed in a formal manner, agreement cannot always be guaranteed. For example, the Cluff Lake Board of Inquiry, in examining the issue of uranium

mining concluded that "...based upon the evidence...the added risks to mankind from the peaceful uses of nuclear energy are ethically acceptable." However, after considering the ethics of nuclear power overall, a majority of delegates to the July 1979 World Council of Churches Conference voted to support an international moratorium on the construction of nuclear energy generation facilities.

Removed from these forums, there is certainly no clear consensus about the morality of nuclear power. The issues are complex, the arguments difficult and the choices not clear. In response to this situation, the Canadian Nuclear Association (CNA) sponsored the "Seminar on Moral and Ethical Issues Relating to Nuclear Energy Generation," March 12th and 13th, 1980. This seminar served as a vehicle through which members of the CNA could reflect upon the ethical dimensions of the nuclear power question and attempt to clarify the understanding of the moral implications of nuclear energy generation.

Instead of attempting to identify "defendable" moral positions, this seminar sought to educate the participants by examining a full range of moral and ethical viewpoints and concerns with the help of experts from a variety of disciplines. To this end, we chose not to hear from persons who have pronounced moral views. Instead, we sought guidance from those had expertise in examining ethical questions or with expertise in understanding the social consequences of moral decision making, regardless of their opinion about nuclear energy.

From another perspective, the seminar functioned as an important attempt to bridge the gap between the philosopher/theologian and nuclear scientist/engineer. With this in mind, the workshops and informal sessions allowed an interchange between those from the "ivory tower" and those from the "drafting table." Quite understandably, no attempt was made to come up with resolutions finding nuclear power inherently moral or immoral.

These proceedings detail the papers and discussions of the "Seminar on Moral and Ethical Issues Relating to Nuclear Energy Generation." They are an intensive examination of the issues and a documentation of the learning process resulting from the bringing together of theologians, physicists, engineers and philosophers.

D.R. Hardy
Secretary
Social and Moral Issues
Sub-Committee
Canadian Nuclear Association

4.

Chairman's Remarks - Dr. D. Hitchcock

When we were planning this conference we wanted to have a person speak to us this evening who could give us an overview of the ethical and social issues involved in nuclear energy generation. And we are very pleased that George Pickering accepted our invitation.

Dr. Pickering is Associate Professor of Social Ethics at the University of Detroit in Detroit, Michigan. He has a Ph.D in Social Ethics from the University of Chicago. He has published articles and book chapters in various fields of social ethics.

In the last three years he has turned his attention particularly to ethical issues and social issues in the energy field, and he was a witness before the Cluff Lake Board of Inquiry in Saskatchewan on empirical and ethical considerations concerning the role of nuclear energy in the development of energy policy.

We are therefore fortunate to have Dr. Pickering speak to us this evening on the topic, "An Analysis: Social and Ethical Issues in Energy Use".

6.

Integrating Ethical and Technical Considerations in the Energy Debate

George W. Pickering

Canadian Nuclear Association
Inn on the Park
Toronto, Canada
March 12, 1980

I hope it is clear, and I have some confidence that it will be abundantly so by the time I get through, that the introduction of explicit moral considerations into policy matters is no way to simplify an issue. For the last year or more Dr. Ian Forbes and I have been engaged in the effort to identify a framework for analyzing and integrating ethical and technical consideration in the energy policy field. Our major focus has been the situation in the United States, with special emphasis on the argument about nuclear energy; and it is the principal outlines of that study which I shall share with you this evening. Our work has been supported by the Electric Power Research Institute of Palo Alto, California; and some, I am sure, will find that a sufficient reason to doubt our objectivity. I must assure you, however, that I do not speak for the Electric Power Research Institute and that, indeed, I do not even wish to associate that institute with anything which I shall here this evening. Supporting our work does not commit them to supporting our conclusions.

In the matter of energy policy, the technical complexities are at least matched by the ethical complications; and no one should expect either simple understandings or easy resolutions. We believe that ethical analysis and the integration of technical and ethical considerations can be helpful in clarifying what is at stake in alternative policy options; but we do not suppose for a moment that these factors, either separately or together, will eliminate the need for political choice. Ethical and technical considerations do not dictate political choices. Indeed, ethical and technical considerations meet and, to some extent, mingle with political considerations wherever policy planning takes place.

Apparently this rather simple point is not easily understood. For making a similar point last summer at the Power Engineering Society in Vancouver, I was rather sarcastically taken to task for simple-mindedness by a newspaper calling itself the Vancouver Sun, whose editors seem not to know the difference between a democratically decidable political issue and an industrial public relations problem,

a blindness which they seem to share - albeit from the other end of the political spectrum - with certain American multi-national oil companies. Unfortunately they inaccurately attributed this problem to me as well. Therefore at the risk of genuine simple-mindedness, let me say that I, at least, do not believe that the words "political issue" are interchangeable with the words "public relations problem".

As Norton Long pointed out so succinctly some time ago, "The question is not whether planning will reflect politics but whose politics will it reflect. What values and whose values will planners seek to implement?" That is the serious question; and it is a good deal more than a P.R. question.

It is for this reason that many, who may have little interest in the technical details, may nontheless have a compelling concern for the policy choices to be made; whose values or which values will any given policy implement or advance? It is our hope that the integration of ethical and technical considerations which is allowed by our proposed framework will help to clarify those questions.

In our study, we try to develop a multi-dimensional framework for analyzing the social and ethical issuesin energy policy and for integrating ethical and technical considerations and judgements in the analysis of policy options. This is not intended as a merely intellectual enterprise. It appears that there is real confusion about the relative status of ethical and technical considerations and judgements and that this confusion has played some role in the inability of our country to formulate and to pursue any decisive direction in energy policy over the past decade. We have attempted to develop a general framework for analyzing the situation, but we have done this in the context of the specific issues which have arisen within and around nuclear power.

The reasons for doing this are relatively straight-forward. Prior to 1970, it was commonly assumed for policy-making purposes that by the year 2000, the U. S. would probably be taking about half of its energy

in the form of electricity and that about half of that electricity would be generated by nuclear power. Both historic trends and usage and contemporary technological developments tended to confirm those assumptions.

The events of the 1970's, however, have upset those assumptions. Our country has undergone a major transformation in its energy picture. After a century of declining energy costs, by 1975 we were confronted with an energy future - it was already a present reality - in which we were faced with increasing energy costs no matter which way we turned. There was no energy source or energy technology which could promise a return to declining costs. This reversal sent shock waves through the system.

Yet in spite of ten-fold increases in the price of oil during the decade, this nationnearly doubled its reliance on imported oil in the period 1973-78 because it was unable to formulate any effective alternative policy. The case of nuclear energy is a prime example of this paralysis, though by no means the only one. Throughout this period, the American nuclear program, which seemd to have momentum as the decade opened, has been progressively weakened and retarded with each passing year, caught in a cross-fire of ethical and technical claims about its dangers and potentials.

Since nuclear power was to have been no small part of our energy future and since its retardation has potentially as many serious consequences as the oil situation, we have chosen to focus our attention on what has happened to that option and how we might achieve both conceptual and practical clarification of the issues on which it is impaled.

We begin therefore with a review of the historical development of the American nuclear program and the emergence of an organized political opposition to that program. We then identify what appear to be seven of the outstanding issues - Institutional adequacy, Radiation, Reactor Safety, Waste Disposal, Economics and Reliability, International

Consequences, and Alternative Energy Souces - andattempt to identify the range of dispute in relation to each of these. We then propose a framework for analyzing these issues by introducing guidelines for identifying a social justice problem, and indicating how those guidelines expand and impact on energy issues. We suggest how to get morally serious about such issues and in illustration we apply this framework to four of the outstanding issues in the nuclear debate - radiation, reactor safety, waste disposal, and institutional adequacy. We are more than aware of the tentative, the limited and the exploratory character of this enterprise.

While the historical review is by no means an exhaustive history, it is intended to convey the changing contexts in which the American nuclear program and the issues surrounding it have developed. We find, for instance, that the official prospect for a civilian power program were fairly muted in the early days of the AEC, 1947-52. It was with the announcement of President Eisenhower's "Atoms For Peace" that the pace both of reactor development and of political controversy about that development began to pick up. While it is true that some safety and radiation related issues were raised at that time, it appears that the major point of contention revolved around the issue which was then politically salient, private versus public power development, with the Eisenhower administration decisively tilting the nuclear program toward the private power side of that dispute. By the late 1950's, however, it appeared that nuclear power was still along way from demonstrated economic feasibility.

This was reversed in the mid-1960's when Jersey Central Power and Light concluded that General Electric could deliver and economic competitive nuclear power plant (1964) and TVA proposed that with the economics of scale, a 1000 MWe nuclear plant would be competitive even in coal mining country (1966). Between 1966-70 we witnessed the Nuclear Revolution, Part I of which was the ordering of nuclear power plants with capacities in excess of 1000MWe even though none that large had yet been built, nor perhaps fully designed; Part II of which was a sudden expansion in the number of reactors under construction, on order or under consideration - by 1970 with only eighteen reactors in

operation, there were another fifty-three under construction; Part III of which was the dramatic apparent reduction in the cost of nuclear energy and the promise that the best was yet to come by way of breeders.

The Nuclear Revolution Part IV is what we have called the Counter-Revolution. While it is true that there was a back-log of nagging issues within the nuclear program, it was not until 1970 that these issues really began to force their way into the public domain with sufficient dramatic clarity to become the focus of organized political activity in opposition to nuclear power as such. It is interesting to note that the most seriously contentious issues which emerged in public all had their origins as tensions and disputes within the AEC and its associated organizations. As a result, the emergence of these issues into public contention gave the appearance of piercing the veil of a cover-up. The age of the whistle-blower and the public interest group had arrived; and the AEC fell victim to both, perhaps justifiably. On the one hand there were monumental tensions within its complex activities, tensions which were exacerbated by a rather nervously high-handed management style. On the other hand, by virtue of its own procedures for intervener participation at hearings and the rather elaborate public hearing structure to which utilities are subject, the AEC was peculiarly vulnerable to the public airing of its internal tensions and disputes.

While the affair with Goffman and Tamplin did little to bring distinction to the AEC, we are persuaded that it was in the course of the generic rule-making hearings on emergency core-cooling systems that the AEC lost its credibility as an agency and that a determined political opposition to nuclear power coalesced (1972-73). By the time the Rasmussen Report on Reactor Safety came in (1974-75), it was too late. The polarization had taken place; and in many ways Rasmussen's report was one of the first victims of the polarization, embraced in general but unattended in detail by the industry, rejected out of hand by the opponents.

Having reviewed the history, we then examined how these polarizations have affected the understanding and public presentation of the out-

standing nuclear issues. The issue of institutional adequacy revolves around the question of the proper federal role in the development, implementation, regulation, and review of the nuclear option. We find that neither from the legislation no from the contending parties has there emerged any clear national mandate for a positive federal role. The consequence has been to turn the regulatory process into a battlefield on which contending parties have tried to impose their own view of what the national mandate should be each under the guise of technical considerations, with one side disenchanted because the regulatory apparatus will not let them proceed, the other side disenchanted because the regulatory apparatus will not impose a formal moratorium.

The issue of radiation and the questions about its health effects were being raised long before the beginnings of commercial nuclear power. However, since the publication of the report of the Advisory Committee On The Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences (1972), the radiation issue has focussed primarily on the health effects of radiation on occupational workers. That the substance of recent debate is about the risk to occupational workers and not to the general public (to whom much lower regulatory limits are applied) seems not to have been made at all clear.

The reactor safety issue, too, has had a long history. Since the issuance of the Reactor Safety Study (WASH-1400 or the Rasmussen Report), the issue seems to have come down largely to the credibility and/or accuracy of this report and to whether one sees safety in terms of the possible consequences or in terms of technical risk (i.e. consequences multiplied by probability). Large differences of opinion appear in many instances to be a matter of how or whether probabilitiesare factored into the opinion. Most recently, the accident at Three Mile Island has raised questions about the adequacy of both the operation and regulation of commercial nuclear power.

The waste disposal issue centers around whether or not a solution exists for the long term disposal of nuclear wastes - and as to what

is meant by saying that a solution does or does not exist. The basic concept, storage of solidified wastes deep underground in a stable geologic medium (most probably salt in the U.S.) has remained essentially unchanged in over twenty years. But the lack of concerted government action (and thereby the lack of actual facilities), compounded by the recent ban on reprocessing (which makes unclear the form in which waste will be disposed), has created a substantial air of uncertainty regarding ultimate disposal.

The economics of nuclear power has been at issue since the early to mid-1970's. Rapid increases in the cost of nuclear plants has led to frequent charges that nuclear power is uneconomical over against its alternatives, coal being the most common comparison. However, the capital costs of other types of power plants and the costs of their fuels have also increased dramatically. As a result, no "winner" has emerged clearly enough as between coal and nuclear to settle this very polarized issue - particularly given the many different costs bases on which such such comparisons are performed.

Concern over the proliferation of nuclear weapons dates back to before the McMahon Act of 1946. But India's detonation of a "peaceful nuclear explosion in 1974, using materials supplied for non-military purposes by the U.S. and Canada, linked this concern to nuclear power. This issue (muted since the Administration's decision to defer reprocessing and the breeder) has set apart those who believe that nuclear power is inevitably linked to nuclear weapons and those who believe that with adequate safeguards nuclear power has little if any impact on weapons proliferation.

The alternatives issue arose not only from a need of critics to be able to suggest alternatives to nuclear power but also from environmentalists' desires to suggest broad alternatives to the prevailing industrial system and lifestyles. Starting from the late 1960's and Earth Day, the alternatives movement consolidated its energy policy thrust with the publication of Amory Lovins "soft energy" strategy and Dennis Hayes' Rays of Hope, culminating in Sun Day. Strong differences still exist between those who believe that nuclear power is

necessary and those who believe that nuclear and other "hard" energy sources can be replaced by solar-based sources in a few decades.

Having reviewed these impasses we then make our constructive conceptual and interpretative proposals for trying to break through the policy paralysis which the polarization of pro and anti has produced. We make explicit several of our key assumptions and identify the principal questions to which a framework should be addressed. First we assume that energy is a basic good both the supply and distribution of which are subject to policy incentives and constraints. Second we assume that any policy will have to cope with increasing rather than decreasing prices. Third we assume that no energy policy will be able to maintain even current levels of distribution, especially for persons of lower income, without the intervention of additional social policies. Fourth we assume that any energy policy will need to be examined in relation to the larger social purposes which it is supposed to serve, i.e., some level of economic growth, some method of allocating access, some standards of environmental acceptability, etc. Fifth we assume also that any energy policy will have to be examined in relation to the social obligations which it might either meet or violate. Sixth we assume that there are and will be differences of opinion and judgement about all of this. Therefore, we identify the purposes of the framework as: 1) understanding these conflicting judgements, 2) refining the differences, and 3) identifying possible areas of practical agreement.

In the development of such a framework, we begin with the question: What is a social justice problem? Here we say that it is the existence of a "rights question" which signals the onset of a social justice problem. Rights questions are inherently but not exclusively political matters. They are inherently political because rights claims can only be effective when they are institutionally supported. They cannot be exclusively political because of their ethical grounding and technical limitations. At root, the question of rights is the question of which human capacities we must necessarily exercise in the course of being distinctively human and freely exercise if we are to be distinctively ourselves. We identify six such capacities:

willing, desiring, judging, thinking, agreeing, responding. We claim that the individual has the right to the free exercise of these capacities and as a result incurs the social obligation to shape institutions and policies which do not violate and which positively facilitate the free exercise of these capacities. Both individual rights and social obligations arise by virtue of the claim which each of us necessarily makes to their free exercise; and it is when the free exercise of these capacities is institutionally curtailed within and between communities that we have a problem of social justice.

We then ask: Why is energy a social justice problem? The prima facie answer is that the mere juxtaposition of the certainties and the uncertainties of our new energy era - the certainty of the increasing cost of energy and the uncertainty of which sources will be reliable and how much energy we will need to produce - immediately presents us with a potentially discriminatory situation, a situation which requires policy intervention. This raises the question of what larger social purposes energy policy is supposed to serve. Should it aim at sustaining current levels of material well-being, current levels of aspiration and expectation, or should it aim at some downward revision in the levels of material well-being and the existing drive for more? We conclude that downward revision could not be justified unless 1) it proved to be unavoidable in spite of our best efforts or 2) there were a deliberate, democratically legitimate political decision to lay down the burdens which existing levels of material well-being impose either on ourselves or on others. In either case, we would still have the problem of working out a downward revision which did not violate the rights of the members of the body politic. We hasten to add, however, that the social purpose of material well-being is actually a complex of goals which do not necessarily exist in any pre-established harmony; i.e. jobs, incomes, choices in styles of living, security in one's person, good health and longevity, and environmental protection, just to name a few.

These issues of material well-being, moreover, are not separable from the institutions through which they are pursued and by which they are

secured; and we suggest that the questions of institutional adequacy are at least equal, in concern and contention, to the general questions of material well-being. The principal concerns about the general question of institutional adequacy which we find active in the energy debate as well as elsewhere are:

1) the problem of the incomplete legitimation and governance of large scale corporations;
2) the related issue of "justifiable harm" in the face of techno-social alternatives and the problems which it raises for "informed consent" in a democratic society;
3) the problem of the inner regulation of scientific development and technological innovation especially in terms of their social consequences; the question is who is "calling the shots" - the professional scientific community, some partisan political or bureaucratic clique, corporate managers in pursuit of profit; the issue is whether these elites have pre-empted the possibility of democratically governing the social consequences of technological change;
4) the question of whether the conservation of environmental resources, biospheric integrity, and public health and safety can be effectively advanced in the face of growing numbers of persons requiring access to basic life-sustaining material well-being;
5) the question of whether the new political calss - the professional-managerial-scientific complex - has the vision and the will to reform the means for democratic participation, for the extension of civil liberties and for informed consent so that they become and remain vital means for governing a technilogical society.

It is clear that none of these concerns is extrinsic to the consideration of energy policy even though it is also clear that none of these matters will be decisively settled by an energy policy either. It is to be hoped that energy policy , while involved in all these issues, will not be held hostage to their resolution.

Therefore we turn to the question: How do we get morally serious about these issues? Here we say that"moral seriousness" does not consist in sorting out the "good guys" from the "bad guys", or in substituting questions of personal virtue for demonstrated professional competence. The morally serious point in the energy argument is this: that every known energy source requires structures of responsibility if its values are to be realized and appropriately enjoyed and if the applicable rights and obligations are to be met. It is just at this point, however, that the anti-nuclear argument makes its strongest claims.

As we understnad the case, the anti-nuclear argument rests on the following complex of beliefs:

1) that nuclear energy poses a mortal threat to a significant number of living human beings even under normal operating conditions;
2) that nuclear energy poses an unprecedented mortal threat to masses of human beings in the event of the worst case accident;
3) that nuclear energy poses a unique threat to the genetic inheritance of future generations;
4) that nuclear energy poses an irreversible threat to the life-renewing and life-sustaining capacities of our environment;
5) that the technical requirement for averting these threats are so complex and uncertain and have to extend so far into the future without any possibility of failure that they cannot in truth be met;
6) that the institutional arrangements required simply to guard against the threats of this technology, even though they are not likely to work, will require such concentrations of power in the hands of the technical elite, whether governmental or corporate, as to endanger any prospect of a democratic polity as well as a wide range of other humane values - all this just to protect this costly and precarious technology;
7) that, anyway, there are perfectly viable alternatives which do not entail any of these risks.

Those who accept all or most of th s complex of beliefs, therefore, consider the risks of nuclear energy to be truly incomparable to any other technology which might be integrated into the normal operations of society. Indeed, they see no way that this technology should be integrated into the normal operations of society.

If we have stated the case at all accurately, it is a moral argument, that is, it is an argument which rests its case, not on the idea that it is not possible to have nuclear energy, but on the assertion that it is not right to have nuclear energy. That is the question which is before the nation. Is it right or not to proceed with nuclear power? If these beliefs are accurate, then nuclear energy probably violates all of the rights and obligations enumerated above. Are they accurate beliefs?

In the attempt to deal with this question, we return to the issues of radiation, reactor safety, waste disposal and institutional adequacy and attempt to uncover the essential arguments in relation to each of these issues.

We find that the radiation argument, on the technical side, focusses largely on the question of occupational exposures. The issue is complicated by the supposition that on both sides of the debate there may be partisan interests which resist such a narrowing of the question and by the fact that there is a conflict between "mainstream" and "dissenting" science. The dilemma posed is that while it is not a function of national policy to resolve scientific disputes neither is it wise to suspend policy until scientific disputes have been resolved.

The potential for harm raises the question of justifiable harm. We propose eight criteria for justifiable harm. If a harm is to be justifiable, then, it would seem that the following are minimal requirements for thinking so:

1) that the potential for such harm has been minimized to its lowest level without thereby depriving the parties of the

basic goods in pursuit of which the risk is incurred;

2) that the decision to live with such risks has been arrived at through a democratic process in which the parties affected have effective voice;
3) that the potential for harm is made as explicit as knowledge allows, ranging as need be, from the certain to the probable to the merely possible;
4) that every effort is made to minimize the consequences for any given individual;
5) that mutually agreed schedules of compensation, either in remuneration, insurance or both, are available to individuals in the event that the harms materialize;
6) that the individual does not incur personal costs in the execution of such claims;
7) that regular channels of due process exist for the monitoring, amending and enforcing such agreements;
8) that third parties do not become the victims of such arrangements.

Under these criteria, we propose that the dire claims of dissenting science can be given their due attention. Industries should have no problem entering into agreements which allow "value of life" type claims in the event that their activities turn out in fact to be more dangerous than their present rational calculations lead them to believe. It is not unreasonable to expect an industry or corporation to risk something at least comparable to what a worker is asked to place at risk.

In the issue of reactor safety, we find that a good part of the isssue seems to come down to whether one's standpoint is the risk (the overall combination of the range of consequences and probabilities) or the maximum possible consequences (with the probability, however low, considered secondary). We say that the ethically salient starting in the discussion of reactor safety appears to be as follows:

1) that by no account is nuclear power the most dangerous industrial process in our society;

2) that by all accounts the calculations of reactor safety are well within the currently established margins of public risk from industrial processes whether one considers the likelihood of small or large accidents;
3) that experts differ, not so much over the likelihood of large accidents - which all admit to be relatively small - but over the justifiability of risking the consequences of a large nuclear accident.

There are difficult ethical questions involved here. What is the ethical difference, if any, between certain consequences, various degrees of probable consequences and merely possible consequences? How much, or in what way should the purposes count in assessing the potential for harm which is incurred in the pursuit of them? We conclude that it would appear that the justifiability of current levels of reactor safety depends 1) on the validity of the general social purpose on behalf of which those risks are incurred, and 2) on the comparative risks involved in alternative technologies by which those putposes can be secured.

In the issue of waste disposal, we begin with the obvious fact which is frequently overlooked; namely, that nuclear waste is here to stay, at least for the next 1000 years or so. The question is: can we do what it takes to get the federal agencies responsible down to the job of establishing an adequate, timely and exceptable program for storing the already existing military and commercial nuclear wastes.

For commercial wastes, we suggest that it might be wise to follow the direction which other countries seem to be taking; establishing interim surface storage (for somewhere on the order of 20 to 30 years); at the same time working toward pilot geologic repositories to demonstrate waste disposal methods; leading ultimately to full scale commercial repositories in a few decades. We need a waste disposal program no matter what the future of nuclear power; and the future of nuclear power may depend on what waste disposal program we get.

We suggest that the most serious problem at the moment is to arrive at some reasonable and achievable overall performance criteria for waste disposal facilities. We suggest that such a criterion, which could be developed in specific and monitorable performance terms is: that the ultimate diposal of nuclear wastes be accomplished in such a way that it does not result in any net increase in risk relative to an ore body typical of that which yeilded the original uranium from which the wastes were derived. We do not insist that this is THE ethical criterion; but we do maintain that there is an imperative to arrive at some specification of responsible policy. Serious talk about obligations to the future generations begins, not in a demand for infinite forsight, but with the specification of present responsibilities and with policies designed to meet performance standards which fulfill those responsibilities.

In the issue of institutional adequacy we note that absolute perfection in nuclear power or any other technology is absolutely impossible and even unnecessary. The problem is to provide incentives for improvements in safety and related matters - to encourage real safety rather than designing a regulatory handicapping system.

In matters of public policy, standards and procedures have to be technically reasonable, but they also have to be publically believable; and the overall question of how to achieve this combination is what we mean by "institutional adequacy". Any known energy source requires structures of responsibility if its values are to be realized and appropriately enjoyed. In the debate over nuclear energy it has been questioned whether there can be structures of responsibility adequate to control the risks arising both from the technology and from the power of the organization required by any reliance on the technology.

If it is thought that the technological risks are potential infinite, that the wastes, for instance, pose a need for 250,000 years of unerring foresight and unrelieved surveillance, then of course the answer is no: there cannot be structures of responsibility adequate to such technological risks and we could only deliver ourselves and

our posterity into the hands of a technologically induced tyranny in the futile attempt to extend present power to meet the demands of such scale and scope. If, on the other hand, the technological risks are of a more limited or limitable nature, then the organizational requirements for governing them may be considerably less demanding.

Thus we can see that in the assessment of institutional adequacy there is a very close connection between the calculation of the technological risks, on the one hand, and the organizational requirements for responsibility, on the other hand. This gives rise to an apparent practical paradox of sorts. The more dangerous the technological risk is said to be, the less likely we are to be able to govern the technology democratically; while the more committed we are to democratic governance, the more we may seem to run the risk of underestimating the technological harm to persons and to the environment. This question of institutional adequacy, therefore, poses morally serious problems for both sides of this polarized debate.

Ultimately it is a political choice whether or not to include nuclear power in the nation's energy policy. There is no strictly technical, nor any stringently ethical ethical answer to the question: What is the wisest energy policy for this or any other country to follow? It is important, however, that such choices be informed by the best technical and ethical assessments of the real possibility and the likely consequences of the technological alternatives. In technological matters, however, it is not, on the face of it, clear where political, ethical and technical judgements take up or leave off. This is especially difficult since the language of science has also become the language of policy legitimation. When it is said that "the experts differ," it is not easy to distinguish scientific from policy differences.

Still, it is both inevitable and desirable that the federal role will be to make authoritative decisions, both domestic and international, under conditions of uncertainty compounded by conflicting advice. The question is how to assure sufficient independent technical com-

petence for the necessarily decisive federal role. We suggest that in spite of the potential for conflict of interest, a sound federal regulatory program requires a rather extensive and independent research, development and demonstration program as its foundation. It is not enough for the federal government simply to provide an arena in which contending parties battle with each other to shape policy. We need public institutions which can get us beyond an endless and fruitless exchange between those who say there are no problems and those who say there are no solutions.

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In conclusion let me depart from my report of the common work which Forbes and I have done and express some merely personal observations. Sometimes the overall issue of nuclear energy is posed as a problem of "public acceptance". True as that may be, I am afraid that language is too superficial to get at the depth of disturbance which is symbolized in the debate over nuclear energy. After all has been said and done to clarify the technical, ethical, and political disputes in the debate, there still remains yet another dimension to it, a dimension which it is exceedingly difficult to discuss without seeming to change the subject. For this other dimension is essentially theological and possibly not in the way which we might unreflectively expect.

The conscious habit in our common culture is to think of Moses and Jesus and the covenantal tradition that joins the one to the other as providing the substance of theology. Long ago, it seems, the maps for our conscious world were drawn locating the origins of faith in the history of Israel and the origins of reason in the history of Greece, giving rise to the apparently meaningful question: What has Athens to do with Jerusalem? We have carried on many arguments in Western culture, sometimes resolving that question in favor of Athens, but mostly resolving it in favor of Jerusalem.

To all appearances that question is before us again, with impersonal technology playing the role of Athens and the claims for humane sen-

sitivity playing the role of Jerusalem, complete with the revulsion from large scale technology as idolatrous. There are those who see it that way and I doubt that I could persuade them otherwise.

It does not however comport with my conception of the religious dimension of our culture. I have never been persuaded that the question was well posed by asking: What has Athens to do with Jerusalem? We are not, as I see it, a culture of one myth, but of several; and the question is: What have Sinai and Calvary to do with Olympus? It is not the conflict of faith and reason with which we are confronted, but the conflicting structures of faith out of whose tensions we have lived which is rising to the surface of consciousness. We have organized our churches around Sinai and Calvary; but we have organized our societies, especially in the modern period, around Olympus.

The essential religion of Western <u>society</u> has been Promethean - with every resource and effort bent toward the making and the re-making of the world in which we live. However, as Charles Morris pointed out some forty years ago, "There is nothing inherently social in promethean activity as such, nor any necessity that this activity be motivated by love of mankind." and that is the religious tension within which we in the West have lived - how to make our promethean urges serve the covenant of justice and mercy, with no guarantee that they will.

For the first time in centuries we have begun to see a religious movement to side with the gods as against Prometheus. It comes as a shock to find ourselves thinking: Maybe it was wrong to steal that fire. What if the price is unceasing punishment, our entrails eaten by day, restored by night, only to be eaten away again as soon as another day dawns?

There are conflicting images of evil emerging among us, both having to do with the proper role of human action in the context of our deepest covenants. On the one side are those who fear that human

action has grown too large, that too much power must inevitably violate the covenant and invade the province of the divine. On the other side are those who fear that we will recoil from our responsibilities, imtimidated by their scale, and thus fail to extend the covenant to its widest possible reach. Each side, it seems, locates responsibility where the other perceives idolatry. Both are strung out in the tension between promethean and christian suffering.

Chairman - Dr. D. Hitchcock

I'd like to echo the appreciation that was just expressed with our applause for the way in which you've given us a remarkably comprehensive overview of the issues that are involved in the debate over nuclear energy, and of the framework which you and your colleague have been developing in order to clarify what is at stake in the debate on these issues, and of the criteria that can be used to try to resolve them in the very polarized debate which exists in our country as well as yours.

It's particularly noteworthy to me that you emphasized that ultimately the question of whether we go for an expanded role for nuclear energy is a political question and that the role of the sort of thing we are doing today and tomorrow and that you are doing in your work is one of clarifying the ethical dimensions and the technical dimensions so that those political questions can be made with a very good kind of base.

And your final remarks, in which you indicate the very deep-rooted nature of the tension that exists in the debate over nuclear energy, from the attentiveness with which they were received, must have commended themselves to all of us.

So I'd like to once again express our appreciation to you. Thank you very much.

It's my role just to give you a kind preview at this time of what tomorrow's session has in store for us. I will try to give you a sense of how the various things that will be going on tomorrow fit together with our speech this evening and with each other.

The first talk tomorrow morning is going to be an address by Dr. Jan Narveson of the University of Waterloo on ethical theory. The conception here is that this will give us an introduction to some of the tools for dealing with the ethical and social dimensions of issues concerning nuclear energy, and a sense of why ethical theory is important in dealing with those dimensions.

Then we have three fairly short papers on specific issues, some of which were raised by Dr. Pickering in his talk.

It is hoped that the overview of issues this evening, the introductory acquaintance with ethical theory, and the three examples of dealing with specific issues will give you a basis for participating in a meaningful way in the workshop discussions tomorrow afternoon. This is an opportunity for many of us to take some risks and do some thinking of a sort that may be unfamiliar. Those of us who have been involved in the organization of this seminar hope very much that you will participate freely and intensely in the workshop discussions.

Finally, the seminar will conclude with three other talks on various other aspects of nuclear energy.

Our first speaker this morning is Jan Narveson, professor of philosophy at the University of Waterloo.

Dr. Narveson holds a PH.D. in philosophy from Harvard University. He is the author of a book in ethical theory entitled Morality and Utility, and of numerous articles in ethics, political philosophy and other subjects. Since we have had a distinction drawn between ethics and real life, it might perhaps be appropriate to mention that in "real life" Dr. Narveson is a devotee of chamber music, which interest he promotes as founder and president of the Kitchener-Waterloo Chamber Music Society.

His talk this morning will be on "Ethical Theory: What it is, and Why it Matters".

Moral Philosophy - What it is and why it Matters!

by Jan Narveson
Department of Philosophy
University of Waterloo

1. Introduction

Since ancient times people have pondered the questions of Ethics, or Moral Philosophy. And, to a degree that some find embarrassing, they keep coming up with similar answers, and they fail to reach agreement on those answers. Nor is there entire agreement about the questions, for that matter. What you will get in this short talk is undoubtedly somewhat one-sided. Even if there were time to explore more sides than we actually have, it would no doubt be one-sided, since I hope to persuade you that although there is room for reasonable people to differ about some of the most important questions, the room is by no means unlimited; some options can be rejected, and others seen to be at least plausible.

Let's begin by making a few essential distinctions. Ethics or Moral Philosophy, is a department of what we may call practical thinking, broadly speaking. Practical thinking is thinking about what to do: we are active beings, we have decisions to make, and we devote some thought to making those decisions (including thought on the subject of how much more thought we should bother to devote to making them). But not all questions of the form "what am I going to do" are ethical, or at least interestingly so. If we want to know how to get to Elmira, our request is for a pretty straightforward piece of factual information; and though questions of fact are unquestionably crucial in innumerable practical decisions, they are not, so far as they go, questions of Ethics. Now, the question of <u>why</u> you are thinking of going to Elmira in the first place could well turn out to involve ethics: perhaps your aim when you get there is to poison the water system or swindle some of the inhabitants out of their property. We can distinguish, then, between the questions: (a) which course of action will work, will bring about what I'm trying to bring about, and (b) <u>should</u> I be trying to bring this about in the first place? The former is about Means, the latter about Ends. Moral philosophy is often thought not to be concerned about Means at all, but that would be misleading. What is true, though, is that many questions of means lie well outside the concern

of the Moral Philosopher: in particular, purely technical ones of the sort that belong in the special sciences. Technical developments, as the present Conference demonstrates, often raise questions of ethics, but the ethical questions are not identical with the technical ones.

And on the other hand, not all questions of Ends are within the province of Moral Philosophy either, I think, and here we need to make a more controversial distinction. We may criticize our aims as well as the actions by means of which we hope to achieve them; but we may criticize them in more than one way. (1) We may be concerned about the meaning, the purpose, the ultimate worth or value of our lives; but (2) we may also be concerned about whether it is morally permissible, whether it is right, to live the sort of life we might want to lead. This, I think, is a different matter, though obviously not totally unrelated. It is different in that one might be living a life which is perfectly legitimate, perfectly O.K., from the moral point of view, but nevertheless unsatisfying pointless, unworthy of someone such as oneself. Let us refer to the latter issue as the Meaning-of-Life question. My point is, then, that that is a different issue from the issue of Morality, and it is the issue of morality which we are concerned with here.

2. Two Theories Rejected

Well, which issue is the issue of Morality, then? What makes an issue a moral issue? There have been many answers to this question. I want to begin by considering two, both of which have had, and still have, a certain following in some quarters, and both of which are, I think, wrong: but wrong in reasonably interesting ways.

(1) One such wrong theory is that moral questions are simply questions about what one's society wants one to do. Every society has a number of rules, customs, requirements (we don't here count the official laws of society as among these for this purpose); and those rules are all there is to morality. Morality, then, is Relative: that is, a given person's morality is the morality of the society he lives in, and it may well be quite different from the morality of any other society. What makes a given moral judgment, in a given situation, correct or incorrect is simply the factor of its conformity or nonconformity with the morality of the society in

which the question has arisen. And what makes the whole issue a moral issue is simply the fact that what is in question is that conformity.

This kind of view has some merits, but it can be attacked on several levels. The merit of it, I think, is mainly this. When we are trying to decide what to do and we feel that there is a moral question involved, we tend to represent the moral factor in the issue as a sort of demand, perhaps even a voice (the Voice of Conscience), telling us to do this or that. Moral relativism has the merit that it answers the question whose voice that is in an intelligible way: it is, as it were, the Voice of Society. Moreover, I think it clear that society does come into the matter in some important way. But which way? That's where relativism doesn't fare so well. In the first place, relativism gets into a real embarrassment in those interesting and by no means unheard of cases in which we feel that society is in the wrong. Society may insist that we participate in some cruel and meaningless ritual, and we may feel that it has no business doing any such thing. But obviously we cannot thereby be feeling that society has a rule against doing what society is telling us to do! And there is another point. Suppose we are dealing with somebody from another society, whose rules conflict with those of our society. Whose, now, do we go by? Or is it meaningless to try to decide which society's rules are the better, or whether some further rule could not be devised to enable us to deal with the conflict? It seems to me pretty clear that the question is not meaningless, but only difficult. And in a world which is increasingly characterized by interactions among the most diverse people (Americans, and Afghans and Russians, for instance) the question of some sort of world morality is surely one to be dealt with seriously instead of dismissed as meaningless.

(2) Let us now turn to the other interesting but wrong theory, which we shall call the God Theory. According to this theory, the rules of morality are not what our society tells us to do, but what God tells us to do. Again, it is a theory which has something to recommend it; but it is also fatally flawed.

One thing it has to recommend it is that there is no problem of relativism, here, since God could presumably want everybody in the world

to behave the same way in certain crucial respects; and at any rate, he could certainly think rather ill of certain society's moral codes. On the God theory, those codes are wrong: wrong because they disagree with the One True code, namely God's. Another point in favour of the theory is that God has some excellent credentials in moral matters. For one thing, he knows everything. This helps, for surely one of the main defects in moral judgment is lack of knowledge. And of course, he would be super-duper intelligent, so there would also be no errors in reasoning, another source of defect in moral judgment. What's more, God is supposed to be Good. Indeed, not just good, but super-excellent - in fact, Perfect. And surely it's plausible to suppose that we ought to do whatever a being who was both perfectly knowledgeable and rational and morally perfect wanted us to do, isn't it?

But the theory again has some crucial defects. To start with a not insignificant one, at least from the practical point of view, we must soberly appreciate that the supposed cure for relativism offered by the God theory turns out to be worth very little when we observe how different are different people's views about God. Indeed, a lot of them don't believe that there is a god at all! Now, it would, for one thing, be pretty absurd to think that what those people believe is that the commands of morality are the commands of God. And as to the rest, whose God's commands are we to accept? The commands of the God the Ayatollah Khomeini? Or the God of St. Paul? Or perhaps the gods of Carlos Castenada?

That defect is serious enough - and has, as we know, led to many wars between followers of rival "Gods". But from the theoretical point of view, there is worse yet to come. For openers, let us ask ourselves just which commands of God would be moral commands - a loaded question, as we shall see. Suppose God suddenly tells you to move to Yellowknife, no reason given. Would that make it morally obligatory to do so? Why? Actually, we may suspect, anyone who thought that God had told him to do that would probably believe that God did have some reasons for asking him to do so, but for some further unknown reason wasn't letting him in on what those reasons are. But the point is, we can't suppose that God's commands could literally be moral ones if they were just arbitrary. What if God tells you to go and assassinate Joe Clark? Again, no reason given. Or what if you were given a reason, and it turned out to be that God just didn't like the color

of Joe Clark's ties? But of course this isn't what the believer expects to happen. Why not? Well, because of the goodness, the moral perfection of God. But now an insuperable obstacle arises. For the God theory has it that the existence of God is the source of moral distinctions, the foundation of morality. Yet now we are saying that we know that God wouldn't tell us to do certain things, and wouldn't give us certain explanations for his commands, because he is too good to do a thing like that. Well, what makes him too good? Apparently his acceptance and conformity to certain principles of morality! But if we need to know what those are before we can be sure what God would or would not tell us to do, evidently it must be possible to find out what those are whether or not God exists; and so, he is not the foundation of morality. Indeed, we must conclude that to posit the existence of God is only to posit the existence of somebody who would presumably be in a very good position to determine the answers to the questions of morality, but not somebody without whom there simply couldn't be any such answers, somebody in the absence of whom the questions simply wouldn't make any sense.

3. A Theory Accepted: What Morality Is

Although there are lots of other possible wrong theories to explore, time doesn't permit, and so instead I shall simply move to what I believe to be the correct one. The question before us is: what is morality? The answer, I think, is this: morality is the set of principles which society has the best reason to ask us to conform to. Not the principles which society does ask us to conform to, for it may be wrong; not the principles which God asks us to conform to, unless he happens to want us to conform to the right ones for society; but rather, the ones which it would be most reasonable for society to ask us to conform to.

The reference to 'society' in this formulation is perhaps a trifle grandiose. In fact, a group consisting of only two persons affords quite interesting material for reflection. But the limiting case of a group is the one containing simply everybody. That is too big a group to be of much interest to us, though. Better to consider simply all whose actions have any appreciable effect on each other: the world's population, for instance, comes nicely under that description by now.

This proposed analysis of morality is meant to tell us the questions, not the answers. Before we can get answers to the question of just what the principles of morality are, we would need to know what is reasonable for people to want and expect from each other; and to do that, we must know something about reasonable activity, rational behavior. (And we need to bear in mind people's potentiality for unreasonable activity, too. We must ask what it is reasonable to expect, in view of, among other things, the fact that people are not always reasonable.) The very fact that we seek rational answers to questions about conduct might be regarded as a kind of bias by some. Certainly there have been, and are, irrational moralities. But if this be a bias, it is an inevitable one: for when we are attempting to <u>think</u> about these matters, what sense does it make to settle for silly answers when better may be at hand? Armed with this analysis, let us return to the main question: what <u>are</u> the fundamental principles of morality? And how do we find out?

How we find out is, in principle, as follows. First, we must have an idea of what it is rational for people to want generally. Second, we need to see whether our answer to that generates any rational interest in having certain general patterns of behavior obtain in society, and therefore of having those patterns instilled into people by the methods of criticism, praise and blame, and so forth. Third, we try to find some suitably simple ways of expressing these requirements, in the form of general statements about what people ought and ought not to do. We eliminate those which are really just deductions from one of the others, or alternative ways of stating them; and the resulting set, as simple and elegant as we can make it, is the Fundamental Principles of Morals. A few brief notes about each of these; but <u>very</u> brief on the third.

<u>5. Rationality</u>

On the first matter, what we mainly need to concern ourselves about is the possibility that there just isn't anything at all which it must be rational to want. Luckily we don't have to concern ourselves about it too much. There may be an odd few, for instance, who literally don't care whether they live or die. We should surely sympathize with such people, and we might have to worry about them too, since that is a notoriously dangerous condition. But we do not have to worry about their effect on our project, for if our question is, what ought society at large to do about such people, the answer will simply be to defend ourselves against them

if need be, and otherwise to ignore them. If a person has nothing to lose which morality might help to protect him from, then he also has no complaint when it fails to protect him from it.

This implies, as will not have escaped the keen-eyed reader, that there is a rational interest in life, for instance. The sense in which this is true is important to spell out. The point is not that to remain alive must be the supreme wish of every rational person. It is, rather, that no matter what our other interests may be, we must be alive in order to pursue or fulfill them. In lesser degree, the same sort of consideration supports a rational interest in the maintenance of one's health and bodily integrity, and indeed in one's mental health and integrity as well, though those are notoriously more difficult to nail down. And it is also true that any one of these interests can be outweighed by something to which an individual attaches still greater value. All of which also implies a further point: that the rational person is one who has values, even though the values may differ enormously from one person to another, and that it is in the light of those values that he acts. He attempts to achieve the greatest possible realization of the states of affairs which he values. This latter implies an interest in personal liberty, which is the condition that others do not prevent one from doing the things which one's values require to be done. The interest in this is so evidently great that there is room to argue that it overrides all else; a point to which we will return.

Philosophers have invented an expression which may be brought in at this point: 'utility'. The idea of this term is that it represents that which an individual values, whatever it is: the more of what he values comes about, the more utility he (by definition) gets. A measure of a person's utility is a measure of the degree to which his valued states of affairs are realized, or brought about. It is intended, then, to be true merely by definition that each person rationally wants to maximize his utility. What he wants to do about other people's utility is another matter; nothing on this score can be assumed right off.

Now, the status of these two notions, of Liberty and Utility, is of extreme importance to moral theory. It would be a confusion to ask: which is the greater value to an individual - his liberty or his utility? For

by definition, utility is simply the measure of what he values, whatever it is. He cannot value something else more than it. But it is quite another matter what an individual might rationally want regarding the values to be incorporated into a social system. He might want society to be concerned only about liberty, for instance. The goal of society's institutions, on that view of the matter, is simply to prevent mutual interference among individuals. On a very different view, however, it might be argued that society ought to be concerned about the general utility, or general happiness. It should arrange its various institutions, including its moral rules, in such a way that if we add up the utility-scores of each person, we get the highest possible total, counting each person's utility as equal in value to each other person's. Or, finally, it might be held that some mix of these two views is possible. For example, many have held that society should be concerned to maximize the utility of those who are worst off among its members, or that it should be strongly concerned with equality in the distribution of goods. How are we going to answer these questions? They are, I believe, the basic ones in moral theory today. My intention here is not to answer them, certainly, but it is to fill in the questions a bit more and to show how they have significance for the kind of practical problems we are here to consider.

6. From Individual to Social Values

If we accept the view that an individual acts rationally when he attempts to "maximize his Utility", and we allow that what has utility for one person might have none for another and that a person might conceivably take little basic interest in others, is there any hope of coming up with an answer to the question which I have suggested is the basic question of moral theory: namely, what general principles, intended for the informal regulation of everyone's behavior, any rational person will want just by being a rational person? The problem is set by the fact that just because we value our own utility and our own liberty, it does not follow that we value the utility or the liberty of others. And indeed, one of the classic positions in moral theory is that morality has no foundations, that it is purely a matter of sentiment or convention, and that the search for rational principles of morals is hopeless. Do we have an effective reply to that challenge?

That there is some reason to think the answer is in the affirmative may be seen by contemplating an extremely interesting class of situations, situations which crop up frequently in all societies. Indeed, we shall choose as our sample such situation one for a "society" containing, in effect, only two people. The situations have come to be called Prisoner's Dilemmas, and are illustrated by the following tale. Once upon a time, it seems, there were two prisoners: Al and Bob, we shall call them. And it seems that the local Crown Attorney has apprehended these two characters, and caused them to be installed at opposite ends of the local prison. The Attorney knows, and they know what that he knows, that they have committed a major crime. And he and they know that he can't convict them of it, unless at least one of them Spills the Beans. But they also know that he can convict either or both of them of a lesser crime, without any confessions. To each he then says the following: "If you Squeal, then if the other fellow doesn't squeal, he'll get ten years in prison and you get off scot free. If you both squeal, you both get credit for it: you both are in prison for five years. If neither of you squeals, you both get convicted of the lesser crime, and you're both in for one year. What do you say?"

The situation is vastly intriguing. For consider Al's situation. If Bob squeals, then if he, Al, also squeals, he gets five years, whereas if he doesn't squeal, he gets ten. So, consulting his interest (and we suppose he has no love for Bob), he should squeal. And suppose that Bob doesn't squeal? Then if he, Al, squeals, he gets zero years in prison, whereas if he does, he gets one year. Clearly he should squeal. And indeed, since Bob's only two alternatives are to squeal or not to squeal, it seems Al should squeal no matter what Bob does. And the same for Bob, for the situation is identical for the two. No matter what Al does, Bob should squeal. Yet if they do both squeal, they are both worse off (5 years in prison) than if they neither of them squeal (1 year)! Note that they are worse off in terms of their own values. We do not have to assume that they are nice guys.

What should they do? Well, in some respects this is debatable, but one thing is clear. If each could somehow be sure that the other would not squeal, it would be better for them than if both just did the best he could according to his own individual lights. If there were some kind of device -

a black box, for instance - which each could actuate and which would bind both of them to silence, then each should actuate it. Is there such a device? One famous philosopher, Thomas Hobbes (1588-1676) thought that the Government could be such a device. I am pretty sure that he was wrong about that. And even if a Government will work to do this kind of job, it can only work because enough people support it, and why do they do that? I think that the answer is Morality. Morality is a set of socially reinforced psychological internalizations which can get us to do things which aren't obviously in our immediate interest - things like rescuing people from fires at considerable risk of life and limb, telling the truth even when it would pay to lie, and so forth. And my claim is that rational persons have an interest in supporting a Morality, if, of course, it has the right sort of principles, namely principles which it is advantageous for everyone to have reinforced in that way.

It might not be amiss to mention a few concrete social examples at this point. Consider, then, the case with Pollution. Suppose you are an individual firm which manufactures certain goods by methods which produce pollution. Pollution is bad for you as well as everyone else: you need clear air and water just as they do. But suppose that producing the goods by non-polluting methods costs quite a bit. And suppose you nicely choose to produce your goods by those methods: what will your competitors do? The answer is that they will probably underprice you by producing their goods by the cheaper methods, and so you will get the worst of both worlds: you get their pollution anyway, and your sales suffer. And similarly with all the other producers in that field. If you all agreed not to pollute, and the agreement could be enforced, then nobody would have to worry about the other guy underpricing him, and you'd all have clean air or water or whatever. A rational morality says: Don't pollute, as long as the others don't either. But it also says that if they do, you can too. A rational morality cannot ask anyone to sacrifice himself pointlessly.

It will not have escaped notice that this very example may have relevance to our purposes at this conference. Of course, nuclear generation of electricity is usually not done by private firms competing with each other. But it is done by nations, and although these nations may not be competing with each other in any significant way, there are plenty of possibilities for prisoners'

dilemmas to arise here as well. Suppose that nation A, for instance, can dispose of its wastes in such a way as to affect the safety of people in B. In that event, the B's may conclude that they may as well use nuclear generation too, since they'll get the disadvantages of atomic waste pollution anyway. And then the C's may be affected; so they in turn will dump wastes in the back yards of the D's, and eventually, of course, the A's will be affected anyway. Even though it might be in everyone's interest to rule out nuclear generation of electricity altogether, it may be in each party's interest, individually considered, to generate it that way anyway.

The general point of view on morality which I have just been developing is known as Contractarianism, since it views morality as a sort of hypothetical contract or agreement, an agreement which it would be rational for everyone to make and try to get generally adhered to in society. Since the contractarian position strikes me as perhaps the most powerful and challenging fundamental view about morality, it will be worth pausing briefly to consider what the fundamental moral principles will be on this view. It seems to me clear that there will be two major ones. First, there will obviously be a general requirement that we keep our agreements. The reason is clear enough: if morality is basically a sort of agreement, a general, rational, mutual understanding that we will do certain things and refrain from others, then the requirement that we keep our various particular, detailed agreements cannot fail to be endorsed. For if there were no obligation generated when we have a definite and explicit agreement, how can there be any when we have a rather indefinite and implicit, indeed hypothetical one? And second, there will be a general directive not to inflict harms on others merely because it is convenient or advantageous for one to do so. It is a basic fact about human life that we are able to inflict damage on others; and this general and basic ability has, of course, been greatly multiplied in recent times by the progress of science. This non-harm principle is, I think, virtually equivalent to a principle to respect the freedom of others: to harm is, I think, to disenable a person from doing what he wants to do. And if the foundation of morality is a rational agreement among distinct individuals with their many diverse interests and values, it is clear that that agreement must have as a leading component that we are to keep off each other's backs in general.

How much more there would be in the fundamental portion of morality on this view is hard to say. I speculate that there would be only one further principle with anything like the status of the first two. This might be called the Minimal Help principle: it calls upon us not merely to refrain from harming others, but also to be helpful to them generally when the cost to ourselves in doing so is trivial and the gain to others substantial. The non-harm principle tells us not to tie people up; the Minimal Help principle tells us to untie them if we can do so without danger or substantial inconvenience. The reason is broadly the same: what it costs us to conform to this principle is (by definition) very small, while what we stand to gain by it if others conform to it as well is potentially enormous - having our lives saved, for instance.

7. Some Knotty Problems

Having said this much about the contractarian view of morality, we may now note an important feature of it for our present concerns. An agreement, made in mutual interest, is, of course, mutual. Fundamental in this view is that we cannot be asked to sacrifice ourselves for others if we have nothing to gain thereby, even in the long run. Now, this means that nobody can on that view, have any really fundamental obligations towards anyone who cannot in principle benefit him. But obviously people in the distant future are in precisely that position. By the time they are on the scene, we shall be off it. We cannot be imagined to be parties to any agreements with them, therefore - or rather, since that would be purely imaginary, there is no point in imagining it. The question therefore arises why we should worry, for instance, about using methods of electricity generation which will affect only people in the distant future. An example, of course, is generation from nonrenewable fuel, such as oil. If we keep at it, it will all be gone, and there will be none left for people in the year 2100, or perhaps even the year 2000, if some prophets are to be believed. Suppose all methods of energy production were like that: then what? Should we worry about the effects on remote generations? The view of morality I have been outlining above seems at first sight to say: not at all!

But that would be much too quick. For many of us do take an interest in future people. We would like to have some around, and we would like them to be in good condition. Perhaps some of us are only concerned about our

own descendants - but then, that's enough of an interest to do. Others may have a curious selfish interest in future fame and renown. Still others may have an aesthetic view to the effect that the world would really be much too uninteresting if there were no people in it. So now: if there are any people who simply don't care about the continued existence of the human race, say, it remains the case that on this view of morality they have to deal with the rest of us who do care. Perhaps some will claim that it is irrational to care about anyone but oneself. But that is not obviously true, at very least. For rationality, on the view I have briefly suggested, consists in promoting one's values, whatever they are (or at least, whatever they are once one has thought about them in the light of what one knows); and so the values of those who care about others are not on that account any less rational than the values of those who do not. The question must therefore be: on what terms do we settle matters as between people who do care in this way about future people and people who do not?

Many people talk as though we settle it by simply ruling out of court those who do not. On their view, the existence of future generations is a matter of moral obligation; those who care nothing about future people are simply immoral and we shall be justified in bulldozing them over if they object. That some people will have this view of the matter is important, for it raises a basic question about morality. The question is, in effect: who is morality for, anyway? My answer is that it is for everyone. It is for everyone, not only in the sense that it applies to everyone—its principles are to be used to criticize the behavior of everyone and not just some or most people—but also in the sense that the values which form the basis of morality must be everyone's values. And I think that the difference of opinion between those who would like to see people around in the year 2500 (say) and those who do not care whether there are any around then or not is a difference of taste; it is not the difference between the righteous and the wicked.

For what reason might people think that we have obligations to see to it that future generations exist? One interesting possible reason is this: some people, I think, have a sort of uncomfortable feeling that if we were to let the human race die out, say, rather than keeping it going, then we

would be, as it were, letting the team down. We would be failing in our duty to mankind if we didn't perpetuate the race.

This view involves a very baffling problem: to whom is this supposed to be a duty? If we don't have any people after, say, 1984, so that eventually there just aren't any more around, then who could we possibly be letting down? For if this happens, then there simply won't be any people in, say, the year 2100. And so, there won't be any people to let down! Nobody in the future will be hurt in any way by this alleged failure, because there won't even be anybody to notice, let alone be discomfited by it! It is also true that nobody will be around to experience the pleasure of life at that time. But equally, we can point out, they won't notice that! So it is simply not true that we owe the duty of perpetuating the human race to future people. If there are future people, we would automatically have fulfilled that duty, and if there aren't, then there will be nobody to be damaged, disadvantaged, or even inconvenienced by the supposed failure.

I may seem to have taken a slight excursion from the main issue here, since the main question is not so much whether there are to be future people, but rather what sort of claims on us they will have if there are any. And I have pointed out that if the contractarian approach to morality is correct, then this is a matter which must be decided by reference to the interests of us currently existing people. Is there another approach to morality on which the claims of future persons are more solidly accounted for?

Of course there are lots of "approaches to morality", if you don't care whether they have any rational appeal. What we surely want to know is whether there are any rational approaches, any views of morality which appeal to all of us as reasonable beings. On one different approach, we do not need to make an indirect argument based on the interests and tastes of currently existing people; on this approach, future people automatically count, just by being people. According to this view, all persons are inherently entitled to equal consideration, no matter where or when they may exist. Future people are still people: so they count. Their satisfactions are to count equally with ours, their unhappiness to have the same weight as ours. It all sounds very elevated and inspiring; it is also very ambiguous and obscure, especially in its implications for the present issue, as I shall explain in a moment. But even before we get to that, it has to be

asked why we should think this, and what the status of these values is. It is, to begin with, fairly obvious that most people simply do not believe what this general view claims: they don't really believe it, that is. To cite just one example: most of us spend quite a lot of money on our own children, giving them fancy toys when infants, good clothing rather than rags, perhaps nice cars if we can afford them. We do this despite the fact, which we all know perfectly well, that the world is simply crammed with people who are far worse off than our own children, and for whom similar amounts of money, if carefuly spent, would do far more good -- such as preventing them from starving to death. We don't treat our own children just equally with other people. (Nor do Canadians treat non-Canadians equally with other people, as will be quickly found out if you try to hire a foreigner for your company, or even to come and play a concert for you!) Now, this difference in status between our own children and other people is not, we should point out, a matter of desert. Our children are no better than anybody else: on no conceivable criterion of merit could any rational parent maintain that his child deserves better treatment than all of those millions of other people in the world who undoubtedly need whatever we might have to offer more than our children do. Still, there it is. And as a matter of fact, nearly anybody would accept that other parents have a perfect right to be just as selfish as we are in this matter.

One could cite other ways in which it is clear that hardly any of us actually believes what this interesting hypothesis of Equality tells us to. This doesn't show that the hypothesis is wrong; but it brings into question whether it is obviously right, at least. And since morality is a practical matter, it suggests that some argument is needed to show why we should accept it. And that will be no easy matter. Meanwhile, however, let us just for a minute longer explore the question of how the adoption of the hypothesis of equality would affect such questions as whether we are within our moral rights to use up valuable resources at the expense of future generations. And here we run into another exceedingly interesting little difficulty. The difficulty comes about because of the fact that the population of the world, as time goes on, has no inherent upper limit. Time stretches out ahead of us forever, so far as we can see. And this means that if there are even just a handful of people at any given time, there could still be

an infinite number of people in the history of the universe throughout time. Meanwhile, however, our question is how to distribute certain natural resources which are, by hypothesis, finite. Well, if you divide a finite quantity among an infinite number of applicants, each person's share is infinitesimal, i.e., Zero. And so if we insist on dividing these resources equally, we may as well all quit using them altogether. If, on the other hand, we wish to justify supplying some definite amount of them to each person, then we will have to limit the number of people there are going to be. And so the question of whether we have an obligation to have future people and the question of what we owe them if we have any cannot be kept completely apart. And then we see that we have to make another decision: where to set the level each person is to have. It can, in principle, be anywhere we like: all we have to do is see to it that only as many people come to exist as can each enjoy that much of those resources.

But that's interesting. If we are indeed free to set the level where we like, so long as we fix the number of people accordingly, it is hard to see how we can have any kind of basic obligation to put it at one place rather than another. And what might it be? We might say, for example, that each person should have enough. But enough for what? To stay alive at all? Or to live well - and if so, how well? How much is enough?

Meanwhile, let us go back to our hypothetical persons who do not care about future generations. The rest of us do care. We are willing to make some sacrifices to see to it that people in the future can have a tolerably good life, by whatever standards we see fit to apply. But these who don't care are not willing to do anything of the sort. What, if anything, may we permissibly impose on them in the way of restrictions on their use of resources which could be valuable to future people?

The answer to that question may well be: None. They are, after all, in no way responsible for the fact that there are going to be lots of people around in the future to make demands on these resources. On the other hand, of course they have obligations toward us. They can't go putting radioactive crud in our Wheaties, and they can't leave dangerous things lying around for us to stumble over; nor can they use up our oil, or whatever, without our say-so. They are entitled to compete with the rest of us for the biggest share share of whatever good things life has to offer, and if they don't want to leave any for their children because they don't want to have any children

to leave them for, O.K. The point is that we cannot say to them that they are taking more than their share and not leaving enough for future people, for if they had their way about it, that would simply be false, since there wouldn't be any future people to divide it with!

8. Concluding Remarks

In this sketch of moral theory, with an application to a couple of relevant issues for this Conference, I have not done justice to many historically interesting views of morality; indeed, I haven't even laid out at much length the main options which seem to me to be of interest currently, apart from the one which seems to me of most interest. Even if we operate within that framework, we have, as will be evident from the preceding deliberations, plenty to puzzle us. But this should not surprise us. Moral philosophy can hardly be easy, when we consider what complicated beings we are. Those complications have always been with us; but when we add to this how enormously the developments in technology over the past couple of centuries - indeed, the past couple of decades -- has increased the stakes and the range of options which confront us, there is still less room for astonishment. Nevertheless, there are some main principles which continue to make sense despite all this, and that is because their rationale is precisely that they are the principles which very different and very complicated people require for the satisfactory adjustment of their interactions. The problem is to make these leading principles fit with the new difficulties thrust upon us by technology, and this problem, I think, is soluble even though very difficult.

Chairman - Dr. D. Hitchcock

Jan Narveson has given us a description of at least five theories about the nature and justification of moral claims, claims about what it is morally right or wrong to do. He has argued against some of these theories, and has endorsed a theory of morality as a kind of ideal contract--the principles which rational people would agree on as being in their long-run mutual interest.

At the end of his talk Dr. Narveson applied this contractarian theory to the question what moral obligations we have to future generations. His talk thus provides a natural introduction to the first of our three papers on specific issues concerned with nuclear energy--a paper by Andy Brook on the topic "Uranium Mine Tailings and Obligations to Future Generations". Dr. Brook's paper, although it deals with the same problem with reference specifically to uranium mine tailings, is based on a different moral theory than that endorsed by Dr. Narveson. The contrast between their conclusions will provide an instructive example of how differences in moral theory can lead to different conclusions about what is right and wrong in a specific area.

Our speaker is an Associate Professor of Philosophy at Carleton University and the holder of a D. Phil. degree from Oxford University. He has published several articles and given numerous addresses on philosophical problems concerned with personal identity, respect for persons and environmental obligations. He is a member of the Advisory Panel on the Long-Term Management of Uranium Mine Tailings, Atomic Energy Control Board of Canada. The objective of this panel is to draft and present the case for new, long-term policies, and it is in connection with his work on this panel that Dr. Brook has developed the position on our obligations with respect to uranium mine tailings that he will share with us today.

Uranium Mine Tailings and Obligations to Future Generations

by

Andrew Brook

Policy questions have at their heart moral questions. Those posed by nuclear energy are often sufficiently complex to tax the full resources of modern moral philosophy. As Arthur Porter has put it,

> ...an assessment of the value of nuclear power...ultimately requires an examination of the acceptability to society of the risk and benefits of the technology, relative to other options. This process is, by definition, extremely difficult since value judgments of a particularly complex kind, transcending nuclear power per se, are clearly involved. Indeed, whose values are to be judged worthy and how this assessment is to be accomplished with justice are pertinent questions.[1]

Indeed they are. A method for determining which values are worthy would be a large step in the right direction. I shall attempt to sketch one, at least in the context of one type of value, namely obligations to future generations.

Any consideration of our obligations with respect to nuclear energy operates in a vacuum unless at minimum it begins from some of the policy-influencing facts peculiar to the industry. The environmental problems found at the 'front end' of the fuel cycle, the mine/mill operation, are an important case in point. Since they are often neglected, we will single them out for special attention, as an interesting test case for our method of determining our obligations. More general applications will then be explored.[2]

MINE/MILL WASTES

A great deal has been written recently about high-level reactor wastes and some other reactor questions such as the risk of radioactive contamination from melt-downs. Curiously, remarkably little is heard about a radioactive waste problem which in terms of radioactivity becomes comparable within 300 to 800 years[3] and which may prove a great deal more intractable to manage effectively over the long-term, namely low-level wastes. The low-level wastes from the fuel refinery or the reactor site (contaminated clothing, etc.) may not be a serious problem. The

low-level wastes from the mine/mill operation, because of their enormous volume, unquestionably are. Yet relatively little attention is being paid to them, even with respect to such basic questions as what real social cost they will impose in the long-term, or what technology is required for their long-term safe management. The AECB, which formed an Advisory Panel on the Long-Term Management of Uranium Mine Tailings in November of 1976, is an exception, and a significant one. The question has received more attention in the United States than it has in Canada.[4] But overall, it has received relatively little attention.

Mine/mill wastes are not an insignificant problem. As a detailed study for the American Physical Society reports,

> The parts of the fuel cycle that contribute the most to public radiation exposure are fuel processing, uranium mining and milling.[5]

This surprising statement refers, of course, to the United States. Canada has no reprocessing facilities and environmental release rates from the mills are much lower here. Most American mining sites are in areas of negative precipitation balance (less rain than evaporation and runoff) so they tend to be very dry and susceptible to wind erosion. In Canada, all sites have a positive moisture balance and so tend to be covered with snow or to be moist from rain most of the time. Even so, the statement is probably not far from the truth even here.

Evidence of the comparative neglect of mine/mill wastes in the public policy arena is not hard to find. The terms of reference of the Hare Committee explicitly excluded low-level front-end wastes (though the Committee in its report indicated that they needed to be studied).[6] The Porter Commission tended to follow the same trend. Although A Race Against Time contains one brief discussion of the question and recommends a panel of internationally recognized ecologists be put to work on the problems involved, in general throughout the remainder of the report the issue is invisible. Nowhere does it receive anything like the detailed attention devoted

to other waste management problems.

When the problem is taken up, the time-frame is usually short. The Porter Commission's discussion, though it considers post-shutdown problems, does so only very briefly and inside a time-frame much shorter than the effective radioactive life of the wastes (at least 100,000 years). The Cluff Lake (Bayda) Inquiry could hardly avoid the tailings issue, and in fact recommended containment in concrete. (Because the ore is so rich -- up to 60% uranium oxide in spots -- the tailings from Cluff Lake will often be richer than the initial ore at other sites where commercial ore can run as low as .15% to .05% uranium oxide.) However, even such containment is short-term. A senior official of the Bayda Inquiry allowed in private conversation that the proposed concrete containers have a life of 100 to 200 years, and that almost no consideration was given to the question of what would -- or should -- happen then.

In the uranium mining and milling process, only about 15% of the radioactivity is removed (mostly in the form of uranium oxide). The other 85% (including radium, the mineral of greatest concern, and thorium, of which radium is a decay product) leaves the mill mixed in with the wastes. Since each kilogram of uranium removed leaves from one-third to two tonnes of waste ore, all of which is very finely ground, and twice as much waste water, these radioactive minerals are dispersed throughout an enormous quantity of inert wastes. In Canada in 1978 about 100 million tonnes of these wastes were in existence; the vast proportion is stored on the surface behind retaining structures, with secondary structures to capture and allow treatment of waste water. After treatment, the waste water is released into natural watercourses.

The radioactivity in these wastes can enter the environment through wind transmission, ground-water seepage and direct irradiation of any living things

which happen to find themselves in the vicinity of a tailings storage area. The transmission mechanism of greatest concern, however, is water transmission. Some of the radioactive material enters waste water in the mill; some more is leached out of the solid wastes in the tailings pile by either the waste water or normal precipitation and run-off.

The dosages to which any living being would be exposed as a result of transmission from tailings would, of course, be very low. And the long-term effects of continual exposure to low levels of radioactivity are not by any means well understoood. Since there is some radioactivity in virtually all soil, we clearly have some degree of tolerance to it. However, there is some evidence to suggest that with respect to the carcinogenic capacity of radioactivity there is no lower limit or threshold below which no damage will occur, and that the effects of exposure in terms of numbers of deaths or injuries is roughly constant for a given amount of radioactive material, so that the same damage will occur whether a few people are exposed to high dosage or a great many people are exposed to a very low dosage. There is also a possibility of genetic damage.

Management of tailings piles and waste liquids in the short term is currently fairly effective. Release rates for most active sites most of the year are within federal standards. However, these management techniques involve continuous, active treatment of the wastes, which may well not continue after the mine/mill operations shut down, and rely on containment structures with an effective life of at most a few hundred years.

Because of the effectiveness in the short run of the current practices, so that real risk of damage from mine/mill wastes will occur at least tens and maybe a few hundreds of years from now, and because of the relative isolation of most tailings

piles, these low-level wastes have been assigned a low priority in waste-management policy. Nevertheless, the water route from these tailings piles has the potential of transporting radioactivity (principally in the form of radium) over very wide areas (e.g. all of the Great Lakes from Lake Huron down), and no measures are in place or even at present required to prevent this from happening.

In fact, there is no general agreement on what measures should be taken. The material cannot be returned to the mines because it doubles in volume in the milling process. Sealing the piles effectively seems unpromising. At some sites, deep lakes exist, into which the tailings might be put. But this solution is obviously site-specific. One promising technology involves removing most of the radioactive materials in the mill, thereby generating a much smaller volume of higher-level wastes, which perhaps could be returned to the mine. However, no machinery for doing so has been proven effective even on a laboratory scale.

Nevertheless, a suitable solution, one which would render tailings safe and remove the need for further intervention in the future, can probably be found, if sufficient resources are devoted to the task. As a portion of the total costs of nuclear energy, any such costs would inevitably be very small, amounting perhaps to at most 1% of the final cost of the electricity generated. And that brings us to the central moral question: are we obliged to assume these costs, or is it permissible for us to pass the costs of tailings management on to future generations?

VALUES FOR THE FACTS

Three kinds of policy question now need to be distinguished: What, from the point of view of policy and its implementation, is being done at present; what is likely to be done; and, what should be done? The third (which sometimes gets mixed up with the second) raises the moral issues (as well as economic, technical, sociology,

managerial and even legal ones), for example, questions about the level of risk which a society is morally permitted to impose in order to realize some advantage, about whether some risks are unacceptable no matter what the gains, about how much we may, from the moral point of view, consume and how much we are obliged to leave for later generations, about human liberty and social and capital concentration, and so on. We will focus on one such question: what costs of energy production are we obliged to assume (given that we are reaping a lot of the benefits) and what costs is it permissible for us to pass on to future generations? The costs (either for management or in pollution and probable suffering, etc.) of mine/mill wastes will be the test case.

It has sometimes been argued that moral views cannot at bottom be argued. They are matters of taste or feeling or whatever. A good counter-example, an argument for a moral view which is as compelling as technical or economic arguments at their best, would greatly undermine such relativism. What follows will hopefully be a step in that direction.

Mine/mill wastes have two useful features as a test case for views about obligations to future generations. Because their handling seems unlikely to yield direct benefits, they raise primarily cost questions: costs to us vs. costs to future people. Thus we can avoid the questions of distributive justice which arise whenever consumption of benefits is in question. Secondly, because harm from the mismanagement of tailings is not apt to appear for at least a few generations, the commands of (even enlightened) self-interest are well in the background, and the genuinely moral issues stand out by comparison.[7]

Obligations and Possible Persons

One argument that we have no obligations to future generations has enjoyed some currency, and should be disposed of. It runs as follows:

1. We have obligations only where someone has rights.
2. Only actual, not possible, persons can have rights.
3. No future person is alive (actual) now.
4. Hence no future person can have rights now.
5. Hence we have no obligations now to future persons.

Even is we accept 1-3, however, 4 does not seem to follow. A person's rights may well exist for more than the period of time in which he/she does. Thus any actual person, no matter at what time in the future he/she is actual, may well have rights now. At most, only possible persons never actualized would enjoy no rights.

The question of whether there will, at some distant point in time, be persons may, of course, have an influence on our obligations. It is a separate issue, to which we will return.

Principles and Obligations

Is there reason to think that we do have an obligation not to pass on the costs of our energy-producing activities? Three basic moral principles, to do with fairness, liberty and freedom from pain, imply that we do:

(a) Fairness: he who benefits should bear the costs.[8]

(b) Liberty: our actions must not result in a preventable and foreseeable restriction of others' opportunities (which disease, pain, mutation or the costs of avoiding these would do).

(c) Freedom from pain: our actions must not result in preventable and foreseeable pain (or discomfort or diminution of ability) in others.

(b) and (c) are, of course, closely connected. In addition to these three, there is another basic moral principle, the right to a minimally decent life, which, though

not so widely accepted, also points in the same direction.

Perhaps many people would be content to stop here. But an unbridled moral sceptic (or someone who greatly desires some contrary course of action) might claim to have been given no reason to bind himself to such principles. Before we could claim that they are rationally and/or morally compelling, we would have to be able to answer him.

To refuse to accept these as reasons at all would be pretty much to get out of the business of justifying courses of action, finding good and sufficient reasons for courses of action, altogether. To consider them, instead, reasons but poor ones would create an onus to find better ones; and it is not clear that there could be stronger reasons than these. Moreover, we do care about these principles — they are deeply embedded in our view of how interpersonal relations ought to be governed, and therefore in our notions of self-respect and sense of decency. Not to consider them reasons and good reasons, or to suspend judgment until we find something deeper, would be to turn our backs on the convictions which are a main component of our moral personalities.[9]

But these two arguments are not decisive either. Fortunately, there is a deeper principle, for which a reasonably conclusive argument can be found, and of which the principles of fairness, liberty and freedom from pain turn out to be at least in part just more specific instances. The principle is the following:-

> prior to considerations of individual distinguishing qualities of moral relevance, each person has the same value as any other.

The argument for this principle is that it would be irrational to assign two people different moral value for no reason at all, or for reasons which could not affect their moral worth. So accepting the principle is the only rational point of view.

To be sure, some discriminatory assignments of value can be justified. Such a distinction between two people could be justified whenever it was founded on a morally relevant difference. For example, having Beethoven's powers may make Beethoven more valuable than John Smith. In general, some people have especially valuable features: genius, sensitivity, maybe even personal beauty, grace or charm. (As will become clear, the argument can be quite generous in what it allows as a morally relevant difference.) Secondly, only a few people (including myself) are within my control; special concern for or discriminating in favor of these people will increase the chances of my doing what I can to procure and distribute things of value. Similarly, special bonds of affection may justify special concern, if the loss of those bonds would seriously undermine a persons's life having any point or purpose in his own eyes, seriously undercut his self-confidence, etc. — in general, reduce his chances of adding things of value to the world.

However, some differences are not morally relevant. Self-interest -- maximizing (or a desire to maximize) one's own benefits and minimizing one's costs simply because the benefits and costs would accrue to <u>me</u> -- is not. No difference of characteristics between me and anyone else has been invoked, and as the 19th-century philosopher Henry Sedgwick put it, mere numerical difference makes no moral difference. Similarly, collective self-interest by itself marks no difference of characteristic between one's own generation and future generations. In general, no one person (even if he is me) and no one generation (even if it is mine) has features so distinctive and valuable as to justify giving that person or generation preferential treatment in the distribution of costs and benefits.

What does the principle of the prima facie equal worth of each person to every other imply? It is sufficient for our argument if it implies that either amounts of costs and benefits, or at least cost-benefit rations, cannot be assigned on any basis which discriminates in favor of some persons over others.

Since we are the ones enjoying the direct benefits of nuclear energy, any passing on of the costs of the activities involved would constitute just such a discriminatory assignment of costs and benefits -- from which it can easily be concluded that we have a moral obligation to find a permanent, passive solution to the problem of uranium mine-mill wastes. (Were we to be passing on additional benefits at least as large as the benefits we are enjoying, and yet assuming half the costs, the conclusion would change. But it seems unlikely that we are doing so at least with respect to benefits.)

Indeed, the three principles, fairness, liberty and freedom from pain, are at least in part just particularized versions of the equal worth principle. Fairness can be seen as the principle that one may not assign costs to others without a correlative benefit and without assigning to oneself correlative costs. Now, infringement of liberty is a cost and so would require a correlative benefit. Similarly with infliction of pain. Or to be more exact, liberty and freedom from pain must go <u>at least</u> this far. They may in fact go further.

<u>Can the Obligation to Future Generations be Weakened?</u>

Some are inclined to import a specifically economists'/accountants' notion of discounting into this issue, and argue that future generations, like anything else in the future, are worth less than the equivalent things right now. This principle, that a bird in the hand is worth two in the bush, can be argued for in the economists' contexts on a number of bases: uncertainties or probabilities; rates of return on present wealth; and so on. It has no relevance here. One discounts the economic value of the future on the basis of its value <u>for me</u> (now); one considers the moral worth of future generations on the basis of their <u>value</u> -- for anyone, including themselves, as much as for me.

There are, however, other discounting principles. Some people might argue that far distant people, just by being so far distant, are worth less per head than people currently alive. While this does not seem a morally-relevant difference, being mere location in time, two other discounting principles are perhaps somewhat stronger.

1. Nature of Future Persons:

   The farther we move into the future, the greater the probability that persons alive then will be different from us in one or another of a number of relevant ways: They may be immune to radiological damage and chemical poisoning; though still at risk, such risks may not in some way affect their interests; their forms of social life may be so different from ours that their moral worth is reduced; they may be such moral monsters that they would not merit our moral concern.

Only the last of these seems to be more than a very remote possibility.

2. Existence of Future Persons:

   The farther we move into the future, the greater the probability that no persons will exist at all.

This claim is sound but ignores the fact (as does the first) that significant damage from radioactive tailing could occur within a few hundred years, a period sufficiently short to reduce the probability considerably.

To see the real moral force of these discounting principles, it is essential to distinguish between <u>epistemic possibility</u> ('it may, I just don't know), and <u>real probability</u> ('it may; reliable calculation reveals a chance of.....which is more than insignificant'). If we just don't know, we can <u>ensure</u> that we have met our

obligations (though we don't, of course, know that we have them either) only by acting as though there will, in the future, be people, and people relevantly like us. And even if we do know that there is some real probability that there won't be, this probability must, I think, be fairly high before our obligation to act as though there will be is significantly reduced -- though this point is controversial. So long as there is any significant probability that there will be relevantly similar people, there is a probability that we have obligations. Thus any discounting principle of which I am aware seems to have only a negligible effect on our obligations to future generations.

Are There Other, Incompatible Obligations as Strong or Stronger?

Here one central issue is the question of costs (at some probability or risk level) and benefits: for a given cost, what is the greatest obtainable benefit? To meet our obligations to future generations with respect to the hazards in radioactive tailing piles would cost something. Would the benefit conferred on mankind as a whole (or, if one believes in obligations to animals or all life, on living things as a whole) from expending resources on these tailings be as great as the benefits we could confer by expending these resources in some other way? I think that if the answer is 'no', our obligations with respect to the tailings would be cancelled -- ought implies can, we can only expend the resources once and we are obliged to expend them some other way.

Whether the answer is 'no' is a complicated, partly philosophical, partly factual question. Philosophical to the extent that we would need criteria for comparing costs and ranking benefits. Factual for reasons which are perfectly obvious.

One example of a possible alternative expenditure of the relevant resources may serve to highlight not only the complexity but also the practical reality of both the philosophical and the factual issue. There is increasing evidence that one unhappy by-product of modern medicine is what one might call pollution of the human gene pool. The exponential increase and spread of diabetes is one example. Certainly passing on a sound gene pool would be a great benefit to future generations. Would the benefit be as great as the benefit of freedom from the dangers of radioactive poisoning from uranium tailings? And could it be secured for a similar expenditure of resources? I doubt that anyone knows the answer to either question — and rational public policy requires answers to them, and to thousands of similar questions.

In fact, two such questions are worth mentioning. What would the balance be if the comparison were with renewable energy?[10] And what would it be if the comparison were with heavy metal contamination? (Heavy metals have no half-life, but retain their toxicity forever.)

These hypothetical questions have been framed in an artificial isolation. The real cost-benefit questions (and hence the real moral questions) are much more complicated. They must also consider the benefits side, and thus such issues as expanding or contracting benefit levels to ourselves or to others, the utilization of benefits for more or for less wealth-expanding and development purposes, and so on and so forth, almost without limit. Rationally based public policy from the cost-benefit point of view (and therefore public policy which meets even the necessary conditions of moral soundness) turns out to be extraordinarily complicated -- something which will come as no surprise to those familiar with the deep and unavoidable information vacuum in which policy decisions are often actually taken.

Some Other Cost-Benefit Considerations

In some contexts, at least three further cost-benefit questions would have to be addressed — thereby adding to the complexity just mentioned. Fortunately, they do not affect our obligations with respect to uranium tailings. (i) Are total benefits of an activity greater than minimum total costs? With respect to tailings, the answer is almost certainly 'yes'. (ii) Are sufficient total resources available at all? The answer is again 'yes'; though the real question here is whether sufficient resources can reasonably be made available; and were the answer not so obviously yes, we would have to go into that very difficult question in a serious way. (iii) Will future generations be able to secure the same benefits for themselves much more cheaply than we can? Although the answer is probably 'no', the whole question can be rejected, if my earlier argument is sound, because it is we who are reaping the benefits of uranium mining and so there is no sound moral reason in general why future generations should be made to assume any of the costs.

It is perhaps worth noting, before we leave this topic, that cost-benefits issues may also be relevant to our previous discussion of probability and its effect on our obligations. There I argued that the probability of there not being relevantly similar people, or people at all, must be fairly high and determinable before our obligations are significantly reduced. This argument may have to be modified in the following way. If the costs of meeting these obligations are fairly high, or if great benefits could otherwise be achieved for these costs, our obligations relative to the probability of there being relevantly similar people may fall faster than would otherwise be the case.

PRINCIPLES, CRITERIA, FACTS

Now to broaden the focus. Since it would be impossible to broaden the moral analysis into all the areas relevant to nuclear policy, or even nuclear policy in the context of the environment, the methodology will be generalized instead. Then we will look briefly at some conceptual issues related to determining our obligations which have not come up in the specific context of mine/mill wastes.

The methodology of the last section for determining what our obligations are, what policy ought to be adopted, has, to simplify, three stages. First, moral principles, as supported by argument (in the last section argument showing the only available alternative to be irrational), determine basic principles of distribution of costs and benefits over populations and times. Then conceptual analysis lays out criteria for setting costs against costs, benefits against benefits, and each against the other. (The need for this was identified, but it was not attempted in the last section.) Probably this is philosophically the most difficult part of the task. Then, with criteria settled for ordering costs and benefits (considered very broadly, to include full social costs and benefits, including indirect and by-product ones), the job of collecting the facts to which to apply these criteria can be undertaken.

This method is hardly new. It is worth laying out so baldly, though, because the moral decisions underlying policy are often made on the basis, really, of hunches, in an analytic vacuum which we would not begin to accept for making design decisions, investment decisions, etc. Similarly, cost-benefit assessments are often carried out with somewhat myopic notions of what can properly be classed under either concept.

Principles and Cost-Benefit Issues

At the point of contact between moral principles and cost-benefit analysis lies a number of thorny issues. These include:-

- the issue of whether the equal worth principle can be realized in equal cost-benefit ratios, or whether equal cost-benefit distributions (so that everyone gets the same amount of each, and not just the same ratio) are required. To some extent, this is merely an academic question. Some level of cost is unavoidable to any being who has to service a human body, so any strict adherence even to the ratio interpretation will achieve at least some measure of distributional equity.

- spin-off, by-product and other systemic effects. For example, using energy to build the industrial infrastructure, find new pharmaceuticals or develop renewable energy techniques might yield new benefits far greater than the benefits consumed.

- distribution questions (which are closely related to the last point). It is clear that we are permitted to consume some benefits. It is also clear that the principle of equal worth rules out as impermissible the consumption of anything which happens to take our fancy. Within these parameters, however, lie an enormous range of options, both with respect to us and others alive now, and us and future generations.

Cost and Risk

In connection with costs, two issues arise which have not been mentioned so far. The first is the question of whether there is such a thing as an absolutely unacceptable cost, whatever the benefit, from the point of view of the principle of equal worth. This (usually not in these clothes) is an ancient and still vexed question in ethical theory. Given the Doomsday aura which surrounds certain aspects

of the nuclear industry, it is a question which some people have from time to time asked. Even the principles, let alone the criteria and facts, for an acceptable answer probably do not exist.

The second is tied to the first: how does diminishing level of risk work, or rather, how should it work, as a discounter of costs? It is quite clear that it does do so as a matter of fact: in connection with the nuclear industry we have been able to accept some potential costs which would be quite horrendous simply because we have been able to convince ourselves that the risk of having to pay them is extremely low. Since we cannot avoid running some low risks of high costs in whatever we do, it seems clear that some discount factor must be morally acceptable. But how much a cost can be discounted as the probability of risk level moves to very small figures is totally unclear. It is an important question in connection with the nuclear industry generally and in particular in connection with our relation to future generations. The principle of equal worth is unlikely to be able to help us with it.

The third starts from the idea (not a new one) that the depletion of non-renewable resources is a cost factor being imposed on future generations. Since depletion is a change in environment, it is also an environmental issue. Classical economic cost-benefit analysis seems not well suited to handling such a cost factor, the suggestion in such theory being that if the price is high enough, the benefit will be provided: a Galilean, single-kind view of benefits perhaps, and one not well-suited to questions of depletion. Criteria for assigning cost values to questions of depletion are needed, and might be difficult to find.

Applications

The methodology for determining obligations to future generations which we applied to mine/mill wastes could be applied to many other nuclear issues, too.

Quite clearly the environmental issues all fall into much the same mold as the tailings problem. They are all questions of the environmental costs of one part or another of the fuel cycle. Equally, they are all costs which, at certain other costs, could be avoided. And they, too, display important areas of opacity which are directly relevant to an accurate cost-benefit analysis. Criterially opaque is the question of the assessment of environmental costs against economic and creature-comfort benefits. Factually opaque are many questions to do with the health physics of low-level radiation, the dissemination rates of such material in the environment, etc.

The methodology could also be applied to most of the non-environmental issues which set the broader context. Included here would be: uranium and the value of a staple-based economy; the value of nuclear high-technology; the terrorism and weapons risk; safety and high-level waste disposal; consumption vs. conservation; and industry structure and social structure. The methodology may not be as helpful for determining how political issues such as federal-provincial relations; public sector-private sector relations; public and interest-group attitudes; or inter-departmental competition should affect policy. Its relation to foreign policy may be the most complicated of all. It clearly is applicable to wealth-distribution questions; but there is more to foreign policy than that.

Clearly, analyses both factual and criterial are needed before real moral conclusions can be reached about nuclear energy and the environment, present or future. Much has been done[11], many policies adopted, a number of fairly well-founded

standards enforced. But more remains to be done, and the whole remains to be brought together within a single framework such as the one advocated above (or some other), before we can be sure of what we are getting into, either factually or morally, in the large-scale expansion of the nuclear energy industry into which we have already entered.

FOOTNOTES

* Associate Professor of Philosophy and Associate Dean of Graduate Studies and Research, Carleton University, Ottawa, and Member of the AECB's Advisory Panel on the Long-Term Management of Uranium Mine Tailings.

1. Royal Commission on Electric Power Planning (the Porter Commission), A Race Against Time (Toronto: Queen's Printer, 1978) p. 153 (cited hereafter as 'Porter').

2. For discussions of the nuclear energy industry as a whole, see, e.g., Walter Patterson, Nuclear Power (London: Penguin), F. Knelman, Nuclear Energy - The Unforgiving Technology, (Edmonton: Hurtig, 1976) or Charles Lee and Ron Glen, Critical Choice: Nuclear Power in Canada (Toronto: Corpus, 1978). The Report of the Cluff Lake Inquiry and the Environmental Impact Assessment of the proposed expansion of mining activity in the Elliot Lake area are basic documents in connection with mine/mill activities. The Hare Report, The Management of Canada's Nuclear Wastes (Ottawa: Department of Energy, Mines and Resources) is the most accessible study on the environmental impact of reactor activity. Porter also provides a good review of the latter issue. Relatively little work seems to be available on the environmental impact of the intermediate stage, the refinery.

3. For more detailed information, see a study done in connection with the Advisory Panel on Tailings of the ATomic Energy Control Board, "An Appraisal of Current Practices for the Management of Uranium Mill Tailings" (AECB 1156).

4. Kilborn Ltd. have prepared an extensive bibliography of relevant publications for the AECB Panel referred to above. Some are referred to in AECB 1156.

5. American Physical Society, "Report to the American Physical Society by the Study Group on Nuclear Fuel Cycles and Waste Management", Review of Modern Physics, 50 (January 1978), pp. 1-186.

6. Hare, op. cit., pp. 1 and 4.

7. Some of the background to these moral issues is well discussed in R. Gaizauskas, "A Philosophical Examination of Our Responsibility to Future Generations", Project on Behalf of the AECB (AECB: Ottawa, 1977)

8. Porter, p. 64, seems to assume that such a principle is binding, though the Report does not really go into the question.

9. Thus questions of self-interest of a very general sort do enter the discussion, albeit indirectly.

10. Part of this question, the part to do with health hazards, has been studied recently, in an extremely controversial report by Herbert Inhaber, The Risk of Energy Production (AECB: Ottawa, 1978).

11. The Porter, Bayda, Hare, Uffen and Ham Reports are good Canadian examples. On the tailings side, large-scale studies have been done by James McLaren Ltd. on the Elliot Lake region, and by Kilborn Ltd. on the long-term questions.

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Chairman - Dr. D. Hitchcock

Thank you, Dr. Brook, for that lucid and compelling argument that we who benefit from the uranium we are mining have an obligation to future generations to pay the costs of long-term disposal of the tailings.

Our second speaker will address the ethical issues in nuclear energy production from a theological rather than a philosophical perspective. The Reverend Peter Hamel, consultant on national affairs for the Anglican Church of Canada, holds an M.A. in theology from Cambridge University and a Master of Environmental Studies degree from York University, a combination that equips him well to address us this morning. He served as Canadian co-ordinator for the World Council of Churches' conference on Faith, Science and the Future at the Massachusetts Institute of Technology in July 1979.

Reverend Hamel will speak to us on the topic "Theological Questions of Justice: Social and Environmental Issues".

JUSTICE AND NUCLEAR POWER - A THEOLOGICAL PERSPECTIVE

Canadian Nuclear Association Seminar on Moral and Ethical Issues

Relating to

Nuclear Energy Generation

Ontario Science Centre
March 13, 1980

by

Rev. Peter J. Hamel
Consultant, National Affairs
Anglican Church of Canada

A Contemporary History of Creation

In the beginning God created Man, which according to all the latest birth control statistics was a big mistake. And God said, "Let there be light," and there was light, and Man called this light fire, and at first it was used to warm him and let him cook his food, and protect him from the wild animals. But then Man discovered you could use fire to burn down a forest or burn someone else's hut or tree house, or a witch at a stake, or soft coal or oil, which made the air turn dark gray and black. And this made Man start to cough and his eyes to run and his sinuses to hurt. And Man finally said, "God, what are you doing to me?"

And after God made the rivers and lakes and streams and oceans, Man dumped all the refuse from the earth into the waters and it killed the fish and the plants and even the oxygen, and the waters turned muddy and brown and smelled, and no one could drink from them, or even sail in them, and finally man shook his fist at the heavens and said, "For God's sake, knock it off!"

And Man created the wheel, and this was good because Man no longer had to walk through the forests or up and down the mountains or to school. And then Man created the engine which turned the wheels and Man no longer had to depend on animals to pull him on the roads and paths. And Man called the new creature an automobile and it changed the face of the earth, for Man was forced to cut down the trees and flowers and pour concrete on the land to accommodate the automobile and drill into the earth and the sea to fuel it, and sometimes the ocean turned black and the air turned brown, and as the automobile multiplied there was less space to park it, and it was unable to move any faster than a

horse, and Man behind the wheel screamed, "Good God, am I ever going to get home.

And Man created the plastic bag and the tin and aluminum can and the cellophane wrapper and the paper plate and the disposable bottle and this was good because Man could take his automobile and buy his food all in one place and he could save that which was good to eat in the refrigerator and throw away that which has no further use. And pretty soon the earth was covered with plastic bags and aluminum cans and paper plates and disposable bottles and there was nowhere left to sit down or to walk, and Man shook his head and cried, "Look at all this God-awful litter."

And Man learned to split the atom and then he took what he learned and he put it in a bomb to defend himself from other Men, and he set off the bomb to see if it would work and it did and Man was very pleased with himself because he was safe from other Men and this was good. But other Men learned to split the atom too and they put it in their bombs and so Man had to make bigger bombs, and the other Men had to make bigger bombs and the explosion put radioactive material in the air which got into Man's food and his water and made that which was nourishing inedible, and that which would quench thirst undrinkable. And again Man became very frightened, and said, "God help us all."

But by this time God had had it and he sent down word to his loyal servant Ralph Nader: "Now Ralph, the first thing I want you to do is build an ark and then....."

(Art Buchwald, Washington Post, April 15, 1970)

In this short history of man Art Buchwald is vividly portraying some of the negative results that have arisen as a consequence of the impressive technological advances that have occurred during man's sojourn on this planet. The Industrial Revolution was hailed as the dawning of a wonderful new age of progress for mankind. It was viewed as progress despite the fact that it brought increased human misery for many of the factory workers. Behind this perspective was the belief that increased happiness was dependent on an aggregate increase in the amount of material possessions. Such a philosophy incorporated the belief that with an increase in wealth all other problems, both economic and social, would soon be solved.

And yet 200 years later, despite an accelerated growth in industry and scientific knowledge, there has come a widening gap between the rich and the poor of this world. Our world is on the limp. Less than one-quarter of the world's population controls and consumes more than three-quarters of the world's resources. It's called the "development gap". "We have produced an economic system," says Erich Fromm, that:

> "...must create people who fit its needs; people who co-operate smoothly; people who want to consume more and more...in order to be adaptable, the modern person is obliged to nourish the illusion that everything is done with their consent, even though such consent be extracted from them by subtle manipulation. Their consent is obtained, as it were, behind their back, or behind their consciousness."

Today we are facing many serious social and ecological problems which have never been encountered before. Ten years ago most Canadians were just hearing for the first time about the environmental crisis. Many people still don't believe we have serious energy problems to resolve. It was only in 1971 that the Federal Minister of Energy, Mines and Resources, Mr Green, told Canadians that we had 923 years' supply of oil and 392 years' supply of natural gas, and that we had better expand our exports before alternative energy sources would make those fuels obsolete.[1] Now we still want to export those precious resources in large quantities even though our supplies are dwindling rapidly.

Economics has replaced religion as the dominant institution in our society. It was not always this way. In earlier societies religion played a dominant role helping man shape his values, priorities, norms and ethics. In essence, religion offered people an interpretation of life which integrated the complex material and spiritual worlds. This religious consciousness enabled mankind to perceive a balanced interrelationship between persons, God, nature and culture.

For many of the world's traditional peoples, including the Native Peoples of northern Canada, nature is not just a treasure-trove of natural resources to be exploited. Nature is a goddess, "Mother Earth", and the vegetation that springs from the earth, the animals that, like man himself, roam over the earth's surface, and the minerals beneath the earth's crust, are all part of nature's divinity. For many Native People, the whole environment is divine and nature's divinity out-lasts man's technological feats of cultivating plants and domesticating animals. In this context, food crops such as wheat and rice, are not just "cereal", they are Ceres herself, the goddess who allows man to cultivate these life-giving plants and taught him the art.[2]

Today the aboriginal peoples of northern Canada are struggling for survival and their right to retain these values which we in southern Canada have given up. We in the dominant industrialized society have treated them as non-people without a culture even though they have been living continously in at least one community in the Yukon Territory, Old Crow, for over 30,000 years! We want their land because of the wealth of energy and mineral resources in it.

This land conflict became a national issue when the oil and gas industry proposed to build a gas pipeline and an energy corridor across the arctic and along the Mackenzie Valley to the United States. The Federal Government set up a commission of inquiry not simply to assess the technological feasibility of this huge project but also to examine the social, economic and environmental

costs to the land and people of the region.

The epic struggle of the Native People illustrates for me the present deep-rooted alienation of industrialized society from the natural world. As Justice Berger pointed out in his report, the heart of the conflict between them and European industrialized society is our understanding of the land. Land for Europeans in North America has simply been a resource to be settled, cultivated and exploited. The early settlers believed that the conditions for civilized existence could be satisfied only through the practice of the Christian faith and cultivation of the land. One early missionary stated that "Those who come to Christ turn to agriculture." That mission remains today: to subdue the last frontier, Arctic Canada, and its people. Before, it meant bringing furs to market; now, it means bringing uranium, oil and gas to southern markets.[3]

If the Native People lose this epic struggle for survival and identity we too will be the losers. We desperately need to rediscover the unity of humankind with both the material and the spiritual universe which the aboriginal peoples of the north have retained. They still have a vital culture because of their living relationship to the land. This is where they receive their sense of identity. At the Berger inquiry the aboriginal peoples described in great detail their special relationship to the land. Only their words can adequately describe their sense of identity:

> "It is very clear to me that it is an important and special thing to be an Indian. Being an Indian means being able to understand and live with this world in a very special way. It means living with the land, with the animals, with the birds and fish, as though they were your sisters and brothers. It means saying the land is an old friend and an old friend your father knew, your grandfather knew, indeed your people always have known...we see our land as much, much more than the white man sees it. To the Indian people our land really is our life. Without our land we cannot - we could no longer exist as people. If our land is destroyed, we too are destroyed. If your people take our land you will be taking our life."
> (Richard Nerysoo, Fort McPherson)[4]

> "Every time the white people come to the North or come to our land and start tearing up the land, I feel as if they are cutting our own flesh because that is the way we feel about our land. It is our flesh." (George Tobac, Fort Good Hope)

Lynn White and others have pointed to the Church as the root of our present day environmental problems. "We shall have a worsening ecologic crisis," says White, "until we reject the Christian axiom that nature has no reason for existence save to serve man."[5] And yet this is not the message I have found in the Bible.

St Paul, in his letter to the Christians at Colossae, was counteracting this very view. The Colossian Church was attempting to drive the divine out of nature and to make it the habitation of the devil and no longer relevant to the Christian. They believed that "thrones, sovereignties, powers and authorities" were outside the concern of God. They confined Christ within terms of purely moral and spiritual power and hope.[6]

In response to this interpretation St Paul declares that all things are claimed by and for God, and all is related to Christ. "Through him God chose to reconcile the whole universe to himself." Here St Paul is saying that the ultimate destiny of humankind is inseparably linked to the whole of creation. Man's salvation is not simply release from the natural order; rather, cosmic redemption is an integral part of personal salvation. Physical nature is not an indifferent factor - the mere stage and setting of the drama of personal salvation. It must be brought within the scope of God's redemptive activity. Our understanding of salvation is incomplete if it does not include the whole of man's experience and environment. Somehow today we must recapture this understanding of nature as our spiritual kin, rather than as an enemy to be conquered or an object to be dominated.

In addressing the ecological problems of our time, however, we cannot return to the Eden of the pre-industrial village. Our challenge today is to build a new society that incorporates modern technological development, protects

ecological harmony and allows for a more just distribution and use of nature's resources among all peoples inhabiting this planet.

Such a society was envisioned by the Hebrew prophets. They too believed humanity was a part of creation and not outside nature. They saw the natural order itself as coming within the covenant with God. In fact, ecological degradation becomes an ethical sign. Environmental pollution is not merely a natural fact, but an ethical judgment on the exploitation of natural resources so often undertaken by the rich at the expense of the poor. Says Rosemary Ruether:

> "When human beings break their covenant with society by exploiting the labour of the worker and refusing to do anything about the social costs of production - i.e. poisoned air and water - the covenant of creation is violated.[7]

In the Biblical view ecological exploitation is linked to social injustice. Both are violations of God's covenant with creation that bring down judgment on man. This view is vividly portrayed in Isaiah 24:

> Beware, the Lord will empty the earth,
> split it open and turn it upside down,
> and scatter its inhabitants...
> the earth is emptied clean away
> and stripped clean bare.
> For this is the word that the Lord has spoken
> The earth dries up and withers.
> The whole world withers and grows sick;
> the earth's high places sicken,
> and earth itself is desecrated by the feet
> of those who live in it, because they have
> broken the laws, disobeyed the statutes
> and violated the eternal covenant...
> The city of chaos is a broken city,
> every house barred, that no one may enter...
> Desolation alone is left in the city
> and the gate is broken into pieces.
>
> (Isaiah 24:1, 3-5, 10, 12)

It is in this context of an ecological theology which links man's destiny to the whole of creation and relates social justice to ecological harmony, that I wish to address the ethics of nuclear power.

THE ETHICAL IMPLICATIONS OF ENERGY PRODUCTION AND USE

Last July the World Council of Churches brought together at M.I.T. some 900 persons including 313 delegates from around the world to discuss the contribution of faith, science and technology in the struggle for a just, participatory and sustainable society. The theme is quite a mouthful in itself. Of the 313 official delegates, half were physical scientists, one-quarter theologians and the remaining quarter were social scientists and representatives of other disciplines. Many topics were discussed in both plenary sessions and workshops including the following: the relationship between humanity, nature and God, the biological manipulation of life, the economics of a just and sustainable society, and energy for the future.

It was this last workshop which brought forward the resolution that is most relevant to this seminar. It called for:

> A moratorium on the construction of new nuclear power plants for a period of five years. The purpose of the moratorium is to encourage a national debate with wide participation on the need for nuclear power, its costs, risks and benefits. [8]

Prior to this conference the World Council of Churches had spent much time discussing the problems associated with nuclear energy and had flatly refused to issue a condemnation of its use. At this particular conference, however, there were at least two new factors which may have had a bearing on the workshop. First, there was the Three Mile Island accident. Second, the energy policy adopted by the Governing board of the National Council of the Churches of Christ in the United States called for "a national energy policy which will not need to utilize nuclear fission;" it also supported "a continued ban on the commercial processing and use of plutonium as a fuel in the United States, and stringent efforts to reach worldwide agreement banning such use of plutonium."

In its discussion of the issue the M.I.T. report pointed out that the energy

problem calls in question the whole type of society in which we live and to which we aspire. Our present energy situation emphasizes the inequalities between rich and poor both within and among countries, the depletion of resources at the cost of serious damage to the environment and the choice of opinions without adequate information.

There appears to be a deficiency of information in at least four areas. First, there is a bewildering array of conflicting projections of the demand for energy and of the availability of adequate supply. Prior to 1977 conventional wisdom for the most part maintained that conservation and renewable energy held little potential and that any transition to a renewable energy base would have to rely heavily on coal, nuclear power and unconventional oil recovery. Within the last year several studies have been published which are a striking departure from this perspective.

In January 1979 Gerald Leach published a paper based on a study done by the International Institute for Environment and Development Energy Project which concluded "that the UK (and by implication other industrial countries) could have a future of prosperous material growth and yet use less energy than it does today." 10 This study emphasized the substantial savings that could be obtained from currently available and quite conventional technologies. It states that with greater efficiencies, demand does not grow over the long term. If other countries currently using a lot of energy followed a similar low energy path, the reduction of international tensions and the drain on world fuel resources could have remarkable effects on global development, equity and self-confidence. It appears quite evident that energy forecasts are falling as new energy-conscious policies and economics emerge.

According to the Harvard Business School Study Energy Future, also published in 1979,..."the United States can use 30 to 40 percent less energy now and still enjoy the same or an even higher standard of living," if it makes

a serious commitment to energy conservation."

This brings up a second area in which there is lack of information. There is inadequate information about the relationship between energy use and material well-being. Some of the more recent studies including the Harvard report point to the fact that the proposed conservation measures are almost exclusively technical changes rather than lifestyle ones.

Third, there is insufficient information on the impacts of energy technologies on health, agriculture, environment, employment, community structures, civil liberties and the poor. Fourth, there is inadequate information on the means by which a transition from oil and gas to other energy sources can be made without serious dislocations in Canada and internationally, especially in the Third World.

Ecological Justice and Human Choice

In making energy choices, all societies must confront deep questions about the type of society they are becoming. Those who decide our future energy policy will influence both the present and the future directions of society. Corporate priorities are profit and growth. If we leave the initiative solely to the energy corporations, either private or public, energy policy in Canada will support the rapid sale of our resources rather than following the national priority of conserving conventional energy sources and developing renewable substitutes. The M.I.T. report notes "we detact a bias toward technocratic decisions, toward elites deciding within countries, toward developed countries making decisions which affect developing countries, and toward economic decisions influencing too heavily political and moral issues."

In an ecologically just society the values of sustainability, equity and participation are paramount. Sustainability refers to the earth's limited capacity to provide resources and to absorb the pollution resulting from their use. A society which is sustainable and considerate of the future must

combat the wastage of the earth's riches and make the use of renewable energy a top priority. This means a much more rational, efficient use of energy and a search for higher levels of efficiency and careful use of nonrenewable fuels. A sustainable society attaches prime importance to all the risks and injuries caused to both human beings and nature by its activities and by its consumption of energy.

Equity as far as energy is concerned, means that all people have access to whatever is necessary for their basic needs. This also means much more equitable distribution between rich and poor, within countries as well as between countries. This applies not only to the main energy resources, but also to the technologies related to energy use. Rosemary Ruether points out the present perilous ecological situation is "a crisis resulting from the way in which a particular exploitative relationship between classes, races and nations used natural resources." [12]

Participation is basic to equity; the individual must have the opportunity to be involved in determining public policy. Basic choices cannot be made by a small body of experts, planners or entrepreneurs alone. This was made abundantly clear during the Berger Inquiry when the people living in the communities along the proposed Mackenzie Valley pipeline were given the opportunity to tell the inquiry-in their own languages and in their own way-what their lives and their experience led them to believe the impact would be of a pipeline and an energy corridor. Over 1000 people gave testimony. Conventional wisdom dictates that such a decision to build a pipeline should only be made by the people in government and industry. Well, the hearings showed that conventional wisdom is wrong. Those ordinary people, the majority being Inuit and Indian, had a great many important things to say even on the most technical subjects. In fact it turned out that the judgment of the planners and policy-makers in government and industry were wrong.

In December I attended part of the public environmental hearings on the

proposed Brinex uranium mining project in central Labrador. The company has been working in Labrador since the mid 50s but the public hearing was not called until last October. This gave the local people a little over a month to prepare their evidence. The company's revised statement was not available until October the 18th and little funding was available to the Indian and Inuit organizations to research their evidence.

The proposed Brinex project is on land claimed by the Labrador Inuit Association and the Neskapi-Montagnais Innu Association, but the terms of reference for the hearings excluded any land claims discussion.[13] Many of the churches in Canada believe that land claims are an integral part of any northern resource development project. In fact they have official policy similar to the Anglican one which states that:

> no new major industrial development in the North of Canada should be initiated on unsurrendered land until either native land claims are justly settled, or terms governing that development are negotiated satisfactorily with the native peoples concerned.[14]

The Labrador Inuit are particularly worried about waste disposal of the tailings from the mine. They live on the coast some 6 miles downstream and their livelihood is gained from commercial fishing at the mouth of this stream. A spokesman for the company admitted there was no safe plan for the permanent disposal of the "hot" wastes, but felt confident that "sometime during the life of the mine, some safe plan could be devised".[15] It seems to me that such treatment technology should be in place before such a short-term 15-year project is undertaken. This is all the more imperative since the Ontario Environmental Assessment Board in its report on The Expansion of the Uranium Mines in the Elliott Lake Area found "that the mill tailings have the greatest potential impact on the natural environment of all the activities related to the mines' expansion."[16]

It is vital as we plan our future energy directions that there be full public participation with adequate research funds for participating public

groups. There must be fuller access to essential information. Evaluation and control procedures must not be kept secret. At some of the public hearings into uranium mining projects industry and government have been seen to withold vital information or to give it out very grudgingly. Despite the complicated nature of the problems, it is vital that democracy must not yield its place to technocracy.

A major reason why the five-year moratorium on the construction of new nuclear power plants was passed by the World Council of Churches' conference was the strong need for fuller participation of individuals and groups in decision-making processes concerning energy. It is just not good enough to rely on energy demand forecasts from the petroleum and nuclear industries.

The Political Aspects of Nuclear Power

There was a feeling within the WCC section working group at M.I.T. that the increased deployment of nuclear power facilities leads society toward authoritarianism. Denis Hayes in his book The Transition to a Post-Petroleum World agrees with this opinion.[17] Many solar and renewable energy supporters believe that renewable energy technologies are more compatible with a democratic, egalitarian society than energy systems based on coal, oil and nuclear power. It is much more reasonable to them to build solar systems in the decentralized fashion than in large-scale centralized plants. Such systems also allow local communities and individuals to manage their own energy needs effectively without reliance on huge centralized sources.

Nuclear Power and the Arms Race

All of the impacts of energy technologies on health, food production, environment, civil liberties, the poor, and community life seem to be dwarfed, however, by the danger of obliteration of future generations from nuclear war. Nuclear disarmament was not scheduled as a topic for discussion at M.I.T. but pressure from some of the scientists present made it possible for a special plenary session to be held. In his address on bioethics, the well known

geneticist Jonathan King, made an appeal to the delegates to bring about the reversal of the nuclear arms race. "Without the removal," he said, "of this gravest of threats to human society, there will be no possiblity of achieving the just, participatory and sustainable society that we all deeply desire."[18] A resolution was passed calling for an end to the development of nuclear weapons and a conversion of science and technology to socially useful purposes. It is worth noting that the money required to provide adequate food, water, education, health and housing for everyone in the world has been estimated at $17 billion a year... about as much as the world spends on arms every two weeks.[19]

Also, out of a recognition that commercial use of plutonium could result in proliferation of nuclear weapons there was another resolution passed declaring that spent nuclear fuel should not be reprocessed in order to extract fissile material such as plutonium, except for separation of small quantities for research and medical applications; plutonium=fuelled reactors should not be built.

In talking about nuclear weapons we are no longer simply discussing a technology. You may disagree with those who believe that the construction of nuclear power facilities leads society toward authoritarianism, but there is no doubt that as long as the atom bomb exists its lethal properties demand that it be controlled by a centralized, rigidly hierarchical chain of command closed to all influences that might jeopardize its deployment. "Indeed," says Langdon Winner, "democratic states must try to find ways to ensure that the social structures and mentality that characterise the management of nuclear weapons do not 'spin off' or 'spill over' into the policy as a whole."[20]

Objections to plutonium recycling not only focus on the economic costs, the risks of environmental contamination and the international proliferation of nuclear weapons, but also on the need to curtail civil liberties. Widespread use of plutonium as a fuel increases the chance that this toxic substance

might be stolen by terrorists, organized criminals, or other persons. In discussing the legal ramifications, Russell Ayres states that "once a quantity of plutonium had been stolen, the case for literally turning the country upside down to get it back would be overwhelming."[21] It follows from this, says Ayres, that "Once recycling begins and the risks of plutonium theft become real rather than hypothetical, the case for governmental infringement of protected rights will seem compelling."[22] It was the potential sacrifice of civil liberties in order to protect against the theft of plutonium that moved the National Council of Churches of Christ in the United States to support a continued ban on the commercial processing and use of plutonium as a fuel in the United States. The soft energy path does not pose the same threat to society.

Summary

We live at a time when it is easy to despair of our capacity to pass through this critical juncture in the history of humankind. Teilhard de Chardin also saw the possibility of "mankind falling suddenly out of love with its own destiny." But this is not where the prophetic vision comes to an abrupt end. The Bible makes it quite clear that the ability of the earth to sustain human life is intimately bound up with the protection of justice in the social order. The restoration of just relations between peoples not only restores peace to society but also heals nature's wounds. Just, peaceful societies in which people are not exploited also create peaceful, harmonious and beautiful natural environments. In such a world:

> ...the wolf shall live with the sheep,
> and the leopard lie down with the kid;
> ...and a little child shall lead them....
> They shall not hurt or destroy in all my holy mountain,
> for as the waters fill the sea,
> so shall the land be filled with the knowledge of the Lord.
> (Isaiah 11:6, 9)

If this biblical vision is to become a reality, if we are to break the poverty barrier for almost two-thirds of the earth's people, if we are to

continue to inhabit the earth, there has to be a revolution in the relationship of human beings both to the earth and to each other, "We hold Earth's future in our hands" says Chardin. "What shall we decide?"[23]

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Chairman - Dr. D. Hitchcock

Thank you, Peter, for those challengining words.

Our final speaker this morning will address a topic that is relatel in an ethical context by both advocates and opponents of nuclear power, the topic of nuclear power in developing countries.

Dr. Robert Morrison is Associate Professor of Physics of Carleton University and Co-ordinator of the Science and Technology Seminar in the Norman Paterson School of International Affairs at Carleton. Holder of a doctorate from the University of Paris at Orsay, he has done research in gaseious charged-particle detectors and in high-powered molecular lasers.

He will soon be taking a leave from Carleton to serve as an advisor on nuclear policy with the federal Department of Energy, Mines and Resources. However, his remarks this morning are those of a private citizen, and do not necessarily correspond to the views of the department.

Dr. Morrison will discuss the likelihood that developing countries will make use of the nuclear power in the next thirty years, and the ethical implications of this likelihood.

NUCLEAR POWER IN DEVELOPING COUNTRIES*

R. W. Morrison

CNA Seminar on
Moral and Ethical Issues
Relating to Nuclear Energy Generation
Toronto, March 1980

I. INTRODUCTION

Nuclear power and development are both complex issues. In this paper I will focus on a few of the essential issues which arise when we consider them together in the context of energy policy. This is not inappropriate to a discussion of ethics, because ethical concerns must ultimately be expressed through policies and their impact on people.

Nuclear power is one possible way of generating electricity. Electricity is one component of energy supply. Energy policy itself is but one of the many factors which have to be considered in a country's overall development strategy. It is probably more legitimate to ask basic ethical questions about a country's overall developmental goals and about how, or whether, it is achieving them, then to concentrate on specific technical means. Nonetheless there are ethical issues associated with nuclear power in the developing countries which deserve our attention. They are in some ways different from those we face here at home.

By developing, or Third World, countries, I mean the countries of Latin America, Africa, and Asia, including the Middle East. I leave out South Africa, Israel, and Japan as being already developed, and draw the line

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at Turkey, excluding southern and eastern Europe. Of course only the wealthier or more industrialized countries in these areas will be interested in nuclear power.

There are three topics which I want to mention briefly but which I will not discuss in detail. The first is the use of statistics. The author of "Small is Beautiful", in one of his last writings, suggested that we should not be so obsessed with counting, that we should not reduce people to units, because each person is a universe. Since I will be using some statistics, I can only hope that in your individual universes you each have a galaxy or two that understands that numbers can be used to illuminate the human condition rather than obscure it.

Another issue I will not consider here is the spread of nuclear weapons and its relation to the civilian nuclear fuel cycle - not because it lacks importance, but because in this forum there is probably more interest in civilian applications of nuclear power, and there are certainly enough ethical questions there to keep us busy. I will only suggest that the proliferation problem is essentially a political one, although technical measures will have to be taken to limit access to weapons grade material in civilian nuclear fuel cycles.

Finally I will not address the question of whether industrialization is good or bad. Nuclear power stands to many of its critics as a symbol of the things they feel are wrong about technological society, and a thorough debate about its merits would inevitably require an examination of the totality of such a society - again the question of overall developmental goals. I avoid that large debate in the interests of brevity, but again state my own prejudices.

I believe that, whatever its drawbacks, industrialization is considered desirable by most of the world's peoples. I think this is primarily due to their perception of its productivity which allows a society like Canada's to produce our food with about five per cent of the population, and our other basic goods with twenty-five or thirty per cent, leaving the rest of us free to work in the service sector and to fly around to conferences on morality.

Since technological innovation does not occur everywhere at once, it inevitably introduces changes in the distribution of wealth and power. Over the long term, within most of the countries which are now industrialized, the distribution of the gains from increased productivity has been perceived as acceptable. As to temporal distribution, those who come late benefit: the people who experience industrial revolutions sacrifice their own welfare for those who follow. No one has mentioned the ethical question of how to repay one's ancestors. Many of the developing countries have been undergoing industrialization in a context of political independence for only several decades, and the question of distribution is far from resolved. Nonetheless, they seem to want the benefits of industrial productivity and to be willing to take their chances on distribution.

With respect to traditional ways of life, I hope that non-industrial modes of existence will be preserved, on a voluntary basis, or for that matter even created, since people have a right to live as they choose and because we all gain from the diversity. However, the rights of pre-agricultural people pose a problem. Their way of life demands large, dedicated areas of land. As population increases and land becomes increasingly desirable, not only for

its economic but also for its recreational and spiritual value, it becomes more difficult to justify exclusive and purely traditional claims on it by small numbers of people.

I will devote roughly equal time to four aspects of the question of nuclear power in developing countries: their energy situation; the characteristics of nuclear power which are relevant to them; the results of a search, made by a colleague and myself, for broad indicators of whether developing countries will undertake nuclear power programmes; and finally the ethical implications of such programmes.

II. SITUATION OF DEVELOPING COUNTRIES

The first feature that strikes one in examining the developing countries is their great diversity, perhaps not surprising given that they comprise about three-quarters of the human race. Three kinds of countries which might want nuclear power can be identified by the most salient features of their economies: industrializing or balanced economies; oil exporters; and poor, populous and predominantly agricultural countries. A plot of urbanization versus Gross National Product per Capita (Figure 1) helps to distinguish some of the countries in each category. In turn, one can characterize two main sectors of energy use in the developing world: the rural and the urban.

Energy Use in the Rural Sector

The most striking aspect of energy use in the rural areas of developing countries is its low level: about half a metric ton of coal equivalent (MTCE) per person per year, compared with about 5 MTCE in Europe and 10 MTCE in North America. This level is only a few times what is required to keep the human

body going. It was achieved by advanced agricultural societies well before Jesus Christ and was probably prevalent through much of medieval Europe.

This disparity in energy use around the world invites ethical questions which are not simply distributive. Our demand for oil in the industrial countries affects directly the price and availability of energy supplies for the Third World countries, supplies which they need desperately for developmental purposes.

Most energy in the rural sector is consumed in the form of biomass - wood, agricultural wastes, and dung. Human and animal energy derived mainly from cereal consumption is another important factor. Biomass energy is considered non-commercial and does not appear in statistical studies of energy consumption carried out by agencies such as the United Nations. Nonetheless it may be a highly marketable commodity.

Societies dependent on biomass are solar energy societies, but they do not necessarily use solar energy in a way which is either renewable or efficient. There is a fuelwood crisis in much of the developing world, and natural ecosystems there are under considerable stress. Increased consumption of biomass for energy will increase that stress and may compete with other uses of land such as food production. Few countries have the forest resources that Brazil can devote to its energy programme. Even in Brazil there is a great controversy about the ecological impact of the deforestation that is occurring.

Clearly better management of biomass in order to increase the sustainable supply is one priority for the developing of rural areas. Another is more efficient use - solar dryers, better stoves, improved charcoal

production techniques, etc. There may be a role here for assistance from the industrial countries.

Commercial energy use in the rural sector is generally small, and consists mainly of oil and its products. It is used for transport and light industry. Oil consumption will grow with increased use of transport, fertilizers, and industry in rural areas - that is, with improved productivity. Electricity is used productively in the rural sector, where it is available, for irrigation, light industry, and other public uses, but not usually for cooking or appliances. It tends to be expensive, because the load factor is low and distribution costly, and because people are poor. Human labour is economically cheap. It is less "costly" to have children spending hours every day gathering twigs and branches than to use commercial energy. One wonders if the right discount factor is being applied to the future of the children and their environment.

The area density of rural energy use in the developing countries is about .05 watts per square meter (w/m^2). This can obviously be supplied (since it is) from the solar input, which is about 150-200 w/m^2 on average through most of the developing world. However, it will take considerable improvements in the conversion of solar energy if this low level is to be increased without damaging the environment irretrievably.

Energy Use in the Urban Sector

The level of energy consumption in developing area cities is about 1-2 MTCE per person per year, a factor of only about 5 times lower than that in the cities of industrial countries. Because cities in the developing areas are more closely packed, the area density of energy use is roughly similar, about 10 w/m^2. It is difficult to imagine that this could be

supplied by solar energy falling on the city itself. Energy has to be brought into cities, and centralized gathering and distribution systems will continue to be necessary. In fact, the scale of such systems may have to increase, since most areas in the developing countries are undergoing rapid urbanization, and some of their cities are acquiring staggeringly large populations. Mexico City is expected to have a population of up to 30 million by the end of the century.

Urban energy is mainly commercial (oil, coal, gas, electricity). There is some use of wood in the form of charcoal for cooking among the poorer sectors of the population. Commercial energy in turn is used mainly in the urban industrial sector. In many African countries, commercial energy use is only about 10% of the total. In India it is probably about half. In the more urban and industrial developing countries, such as Argentina and Korea, most of the energy is consumed in commercial form.

Commercial energy is principally oil in the developing countries, and the oil is in many cases imported at world prices. Most of them bypassed the coal phase of industrialization and went straight from biomass sources to oil. Exceptions are India and China, which are strongly coal-dependent, and Korea and Turkey which are somewhat less so.

About half of the population of most Third World cities is very poor and deprived of even the most basic services. The other half is broadly comparable to the populations of industrial-country cities. In India about fifty million people live in this productive urban-industrial sector.

Electricity

Like other forms of energy, electricity is used productively in most developing countries. The proportion devoted to industry is usually 60% or more, sometimes 90%, compared to levels of 40-45% in Canada and the United States.

For most of the developing countries which are contemplating nuclear power programmes, electricity constitutes about 10% of final energy use, as in the industrial countries. In small, densely populated countries with fewer transport needs and high levels of industrialization, such as Hong Kong and Puerto Rico, this proportion may be up towards 20%. Hydro power has been a key factor in the development of Brazil, where electricity represents 16% of end-use.

For those countries where the economy is 100% dependent on fossil fuels, electricity will consume about 25% of the primary energy in thermal power stations. In fact, in the developing countries which have, or may acquire, nuclear power programmes, about half the electricity comes from such thermal stations, mainly oil-fired. The other half comes from hydro.

Electricity is a desirable form of energy. Its use grows faster than GNP in almost all the countries we studied, often at double the GNP growth rate. There is some controversy as to whether electricity is a cause or effect of GNP growth, but few countries seem to regret the electrical capacity they have in place, and power shortages are often cited as obstacles to further development.

An example may illustrate the enthusiasm for electricity in developing areas. In the industrial city of Monterrey in Northern Mexico, there is a Marxist-Leninist commune called Tierra y Libertad which is virtually

self-governing. The commune rips off electricity from the city lines. The utility ignores the theft for reasons of political convenience. Within the commune minor infractions are punished by having one's hair shorn or working an afternoon on public projects. More serious misdemeanors, like public drunkeness or missing a meeting invite heavier penalties, such as ... losing one's electricity for several weeks.

While electricity demand is strong, the main commercial energy problem in most developing countries, in both the rural and the urban sectors, is oil. In this they are like us in the industrial countries. However, oil is even more important to them. It is used for purposes which are more essential. It plays a bigger role in their economies and leaves them more vulnerable to disruptions in supply. At the same time, they have fewer financial and technical possibilities for substitution in the short term. Also, they are going through an energy-intensive phase of their industrialization.

Anything which helps to relieve the pressure on the price and availability of world oil will help the developing countries - conservation (there are fewer possibilities for conserving oil in the developing countries), substitution, new supplies. However, global oil demand is mainly a function of the policies of the industrial countries. Here again, disparities in the levels of consumption raise an ethical problem of planetary scale.

III. CHARACTERISTICS OF NUCLEAR POWER

The most arresting features of nuclear power systems are their scale, complexity, capital intensivity, and the unique nature of the hazards associated with them. These impel strong commitments on the part of any country wishing to adopt nuclear power.

Scale

It is believed that units of 600 MWe are about the minimum economic size. Utilities consider it unwise to have more than about 10% of their capacity in a single unit. This sets a lower limit of about 6000 Megawatts (MWe) of capacity on the integrated grid size which a utility should have at the time the first nuclear reactor comes on stream. If capacity is growing at 7% per year it will double in ten years. In many developing countries the rates have been higher than this. A country with an integrated grid of 3000 MWe now could order a 600 MWe reactor to be commissioned in ten years' time. There are 20 or 25 developing countries which will have grids of 6000 MWe by the end of the century. Ten of them already have nuclear reactors on order or under construction.

Complexity

Nuclear technology is more complex than other forms of electricity generation, and requires higher standards of manufacturing, operation, and regulation. These place severe demands on manpower, industrial infrastructure, and institutions, all of which must be prepared well before the first reactors come on stream. Even bargaining intelligently with foreign vendors for a nuclear reactor requires considerable groundwork. Clearly a serious long-term commitment is required of a country undertaking a nuclear power programme.

Of course a country can rely to some extent on the supplier, and may have to do so for some services, but this introduces an unwelcome degree of dependence. Most countries embarking on nuclear power strive to achieve a maximum degree of control over the whole operation, by assimilating the technology as soon as possible in the sequence of reactor construction.

Desire for autonomy extends over the whole nuclear fuel cycle, from the

resource base through fuel fabrication (and, for light water reactors, the enrichment stage), to the reactor technology itself and on to the disposal of the wastes. While most developing countries are not likely to need reprocessing technologies for recycling the fuel for some time, this is an issue for the longer term. In fact, few countries are likely to be able to achieve complete autonomy over the whole fuel cycle and they are correspondingly concerned, as are many industrial countries, to obtain guarantees of continued access to fuel and technology commensurate with the investment they are making.

It is often said that because uranium supply is very limited, the present generation of fission reactors is only a brief transitional phase. The implication is that it would be foolish for developing countries to invest in energy systems which will soon run out of fuel. In fact, present world uranium reserves represent an amount of energy roughly comparable to remaining oil reserves when either source is burned in thermal plants to produce electricity. It makes more sense to burn uranium for electricity than to burn oil, since it has fewer alternative uses. Also the probability of finding more uranium seems at least as great as that of finding equivalent amounts of oil, and the price of electricity from uranium is much less sensitive to fuel costs than that from oil-fired plants. Advanced fuel cycles which convert abundant uranium 238 and thorium to fissile fuel may eventually extend the nuclear resource base by orders of magnitude. Fission is not an infinite energy source but it is hardly a will o' the wisp.

Cost and Capital Intensivity

Nuclear reactors are expensive and they are capital intensive. The smallest-size reactor available, that of 600 MWe capacity, costs about a billion dollars. For the first few units bought by a developing country, much of this would be in hard currency. We estimate that interest payments on such a sum should not exceed about 1% of a country's Gross National Product (GNP). This sets a lower limit of about $10 billion on the GNP a country should have if it wants to obtain a nuclear reactor.

Despite the large initial costs involved, the unit costs of electricity from nuclear power seem to be in a competitive range in many parts of the world. In North America nuclear electricity seems to be much cheaper than coal-fired, except perhaps in some coal-mining regions. The competition will depend to a large extent on the different regulatory, environmental, and money-raising conditions placed on the respective plants, and on their actual performance records. Nuclear power is certainly much cheaper than oil-fired electricity at current world prices.

A 1000 MWe reactor operating at 80% capacity factor displaces about 10 million barrels of oil each year, worth more than $3000 at current world prices. Thus there may be significant opportunities for substitution of nuclear for future oil-fired electricity in the Third World.

The characteristics already cited suggest that a nuclear power programme is a fairly redoubtable undertaking for a developing country. Many of them are short on foreign exchange and on qualified manpower. They have many competing demands for investment. Institution-building is difficult. However the characteristics are self-regulating to some extent. A country which cannot effectively pay for, use, or effectively control a nuclear power programme

is unlikely to lay out billions of dollars on the off chance that things will work out.

One hopes that planners in developing countries will consider carefully the alternatives and the opportunity costs, not only in energy supply but in other fields of investment, before deciding to go ahead with a nuclear programme. Such planners are likely to be acutely sensitive to the problems, and probably do not need much advice from us on that score. If countries can afford the investment, assimilate the technology, and put the electricity to good use, nuclear power could well turn out to be an appropriate choice over the long term. At the very least, it provides a useful extension of the spectrum of energy sources to be considered.

Environmental Aspects

In normal operation, the once-through nuclear fuel cycle seems to have less environmental impact than most other large-scale energy systems. One can compare its effects with acid rain, carbon dioxide buildup, extensive use of land for gathering renewables, flooding, and other effects of hydro projects, and deforestation.

Health and Safety

Nuclear energy has a unique set of dangers associated with it. The density of the energy in nuclear fuel makes for a concentration of its destructive potential as well. The principal threat is nuclear weapons, but the radioactivity contained in nuclear materials also presents a serious hazard. This makes comparison with other forms of energy problematical.

In normal operation, the risks from radioactivity are small. Reactors contribute a small fraction of the natural background radiation. High level wastes are small in volume and should not prove intractable. The main source

of risk in the fuel cycle as presently managed is probably the radioactivity in mine operations, and in mine and mill tailings, which are low in level but large in volume.

The question of greatest public concern, however, is probably that of reactor safety. Reactors contain a large inventory of radioactive materials and the fear is that in an accident enough of this material might escape to cause serious harm to large numbers of people. The probability of this happening is considered to be small, but the potential damage resulting from the most serious imaginable accident is large.

This raises ethical questions of a fairly new type: at what level of numerical probability do serious accidents become tolerable? The problem is compounded because the probability of rare events is itself an estimate and arguments tend to be highly statistical. The public seems to be happier with risks which are better known, such as automobile accidents, even if the overall damage (probability of an accident times its impact) is much higher. Ironically, death and injury seem to be more acceptable if they are more certain. Whether this represents a rational response remains a subject of debate.

Hazards of the nuclear fuel cycle, including reactor accidents, are more likely to be manifested first in the industrial countries simply because of their much higher intensity of nuclear power development. Uranium mining is also carried out on a larger scale in developed countries. This is as it should be. It would be unfair to use the developing countries as test beds for a new and complex technology whose risks were not well known.

There is some question as to whether the risks of nuclear power might not be greater in developing countries, where quality control and rigourous

operating procedures for large institutions and complex technical systems are less well established. This seems to me to be just one more factor which developing countries must study carefully and prepare for in choosing to adopt a nuclear programme. Once they make their decision, there is nothering to suggest that they are inherently less capable of managing it properly than utilities in industrial countries. In fact some developing countries look to advanced technology industries such as nuclear power as a means of upgrading their industrial and scientific skills and standards.

One implication of the transfer of nuclear technology is an ethical obligation on the part of the suppliers to ensure that information and assistance are made available to the operators on a continuing basis. This seems to be an important factor in avoiding accidents such as Three Mile Island, and in ensuring good performance.

Centralization and the Distribution of Benefits

Its large scale, technical complexity, and capital intensity indicate that nuclear power is most effective as a baseload power source for large demand centres - big cities, big industries, or both together . It also suggests that the administration is likely to be highly centralized, that the relatively few jobs in the system will be highly technical and managerial, and that the output will serve the urban industrial sector of the economy, that is, the elite minority. These institutional factors are often cited as one of the disadvantages of nuclear power in developing countries. The same argument applies to other forms of centrally generated electricity and, indeed, to any other large, capital-and-technology intensive project. The issue does not usually arise in industrial countries. Despite the occasional protest about the nuclear priesthood, the benefits of centrally generated

electricity are seen to be fairly widely distributed. The countryside is fully electrified. Customers there pay essentially the same rates as city-dwellers, suggesting that the additional costs of rural distribution are subsidized by the urban and industrial users. Since income distribution is fairly uniform, rural dwellers make as much use of the products made from electricity as people in the cities.

The distributive issue is a fundamental one in developing countries, since all the indices tend to be highly skewed in favour of the urban sector. It is particularly acute in the poor, populous, agricultural countries where upwards of 70% live in the countryside, at very low levels of productivity, and contribute through their migration to the rapid growth of shanty slums around the cities. Debate about the distributive effects of different development strategies is complex but a few points might be made here.

1. As mentioned earlier, Third World cities are large and growing, even in agricultural countries. They have their energy needs too, and their industries seem to use energy productively in the development process.
2. Even if one wants the majority of investment funds to contribute to rural development, not every project has to do so directly. An industrializing country will need energy sources for its cities and industries and it must balance its need for these against its other needs for the equivalent funds and human resources.

The appropriate allocation of resources is not only an ethical question, it is also the essential problem of public policy.

3. Nuclear power may in fact serve rural development, by providing energy for such inputs as fertilizer and machinery.

4. The electricity may itself be useful in rural development. Large-scale electricity in urban areas, with the attendant economies of scale, may be able to subsidize extensions into the countryside. One can imagine that around each urban area there would be a zone where it is economically (or, perhaps, politically) useful to extend electricity. Beyond that zone, renewables or oil products would be more competitive. The s of the zone would depend on the cost of competitive sources, and on demand factors such as population density, average income, and the degree to which electricity can be productively used. In densely populated, more industrialized countries, such as Taiwan and Korea, one would expect these zones to cover the entire country, as they do in North America and Europe. In poor, populous, agricultural countries these networks would radiate out some distance from the cities.

5. Decentralized institutions are not inherently virtuous, nor centralized ones bad. Local power groups in developing countries may be hierarchic, static, and self-perpetuating, if not actively incompetent or corrupt. Central government agencies may be more interested in developmental goals and social change and more effective in getting things done.

6. It should be noted that inequities of distribution are not limited to projects in the urban industrial sector. Attemps to bring benefits directly to the agricultural sector have also been accused of concentrating wealth and power: irrigation projects and green revolution technology, ostensibly scale neutral, are common examples. The distribution of food to the rural poor has undermined agricultural incentives. Even the control of epidemic diseases and of widespread famine, which have probably raised life expectancies most among the poorest sectors, have resulted in population growth which has depressed

the conditions of people in the poorest sectors most. They have survived, but not to great expectations. The point is that distribution of benefits is as much a function of politics as of technology.

7. If capital projects which increase productivity are to be foresworn because of their distributive effects, it is difficult to envisage how productivity will grow. That is, if the principal aim of development projects is to create jobs, priority will be given to labour-intensive techniques which are in conflict with improved productivity. It is possible that there may be a range of intermediate technologies which are both more productive and more job-creating than traditional techniques (presumably output has to expand), but they are not likely to cover the entire range of technical activity. In this approach jobs are more important as a means of distributing income (and a sense of social usefulness) than in providing goods and services.

Professor Narveson gave us an example of the utilitarian approach in which the overall pie is very large but the distribution very uneven. The problem is similar to that created by the introduction of highly productive modern technology into labour-surplus developing countries. Is the uneven distribution a rigid precondition for the expansion of output? Is there no way of obtaining a reasonable trade-off between increased productivity and fairer distribution?

Can income be distributed only through relatively unproductive jobs in the producing sectors? We seem to have found ways around this problem in the more industrial countries, suggesting again that the solution may be political as well as technical.

IV. INDICATORS OF NUCLEAR POWER IN LDC'S

Here I will report briefly on a search, made with Gordon Sims of the Atomic Energy Control Board, for broad statistical indicators of wheher developing countries will undertake nuclear power programmes and of how large their programmes might be.

We found that a combination of high energy use and high energy intensivity, that is high energy use per unit cf Gross National Product, was a useful indicator. Figure 2 shows a plot of energy use in MTCE versus GNP for a number of countries of interest, including some industrial countries for reference. The curved line separates out all the developing countries with nuclear power programmes, shown as circled on the graph, along with a number of plausible candidates. (Libya, Cuba, and Turkey, which are apparently obtaining 440 MWe reactors from the Soviet Union, are shown with dashed circles, as less is known about these arrangements.) Libya, and, interestingly, Switzerland, are below the line.

Another useful indicator is the size and growth rate of electrical generating capacity. This is shown in Figure 3 for the countries of interest, extrapolated into the future from data for the period 1966-76. Extrapolation is the easiest and most dangerous form of prediction: the growth trends are unlikely to continue as shown. However, they at least give some idea of what has been going on until fairly recently, and suggest that about twenty countries may go over the 6,000 MWe threshold before the end of the century. (In many cases there is no integrated national grid, so the capacity shown represents an upper limit.)

Of the developing countries with nuclear power programmes, seven - India, Brazil, Mexico, Argentina, Iran, Korea, and Taiwan - are well up on these indicators. Egypt, the Philippines, and Pakistan are somewhat lower.

Per capita indicators of GNP, energy or electrical consumption, or physical quality of life (PQLI) were not found to correlate very well with nuclear power programmes. Nuclear power seems to depend on the absolute size of the urban industrial sector in a country, not on the average distribution of wealth or energy.

The existence of indigenous energy resources raises some interesting questions. The most direct competitors for nuclear power are probably coal and hydro. Many of the larger countries which have adopted nuclear power also have fairly large potential coal and hydro resources, although these are often fairly remote from the demand centres. Nuclear power seems to be considered by those countries as a valid alternative. The existence of other potential sources of electricity probably decreases the degree of their commitment to nuclear power, but they maintain it as an option nonetheless.

China has avoided nuclear power until now. This is probably due to a combination of a strong desire for self-reliance, an emphasis on rural development through the use of renewables, and an indigenous energy endowment which is both large and diversified. China has shown some interest in nuclear power in recent years.

Among the leading candidates, Colombia, Indonesia, Venezuela, Peru, and Malaysia all have a spectrum of alternatives which could lead them to defer

nuclear programmes for the time being. Chile and Thailand seem to have fewer choices and both have a long-standing interest in nuclear power.

Oil reserves are a wild card. One would expect countries which are short of oil to look to nuclear as an alternative, and this seems to be the case. Yet such countries are likely to be short of foreign exchange to pay for nuclear programmes, in part because of their current oil import bills. Turkey and Pakistan are examples that come to mind.

Countries which have surplus oil, on the other hand, often have surplus capital. Nuclear power may represent for them a useful way of investing energy revenue in future energy technology and energy supply. This seems to have been the case with Iran under the Shah. Mexico has decreased its nuclear ambitions considerably since its large oil reserves became apparent, but it continues with a modest programme. Several oil-exporting countries with fairly small grids have shown interest in nuclear power: Libya, Saudi Arabia, Iraq, Algeria, Indonesia. Ability to pay may thus be a stronger indicator for nuclear power developments than actual need. However nuclear programmes based on surplus capital are likely to be more precarious. Again, Iran provides the example.

A number of oil-producing countries flare (burn off) the gas produced in association with it. This apparently mindless waste occurs because it is costly to gather the gas and bring it to markets, which often do not exist locally. Power stations might provide an outlet for the gas, and could thus compete with nuclear power in oil-rich countries. Of course, oil-producing countries have the option of burning oil to generate electricity. They can sell it to their utilities at prices well below the world price. They may

still wish to use nuclear power, which is cheaper than electricity from world-price oil, and sell the oil to gain foreign exchange.

Nuclear fuel resources do not seem to play a large role. Only a few developing countries have enough uranium to run a few reactors over their lifetimes. However, uranium has not been intensively sought in most developing countries and more may be discovered. For the time being most developing countries must obtain their uranium on the world market, largely from a group of industrial countries.

The absence of indigenous energy resources is a strong indicator but by no means an absolute one. Candidate countries without alternatives might be expected to be particularly keen on nuclear power. Such countries are mainly small, industrialized, and highly populated, such as Taiwan, Korea, Hong Kong, Singapore, Puerto Rico and Cuba. Of these Taiwan and Korea have very ambitious nuclear programmes and Cuba is beginning a modest programme with reactors from the Soviet Union. Singapore and Puerto Rico have excess refinery capacity and presumably find it cheaper to burn residual fuel oil. One of Hong Kong's power utilities is a subsidiary of a major oil company. Hong Kong is contemplating an exchange of Chinese coal for Hong Kong power using British technology, and has also shown some interest in nuclear power.

The picture that emerges is varied but not incoherent. The threshold indicators, GNP, energy consumption, and especially electricity use, select a group of about 25 developing countries who might have nuclear power programmes on stream by the year 2000. A few of these may by that time have programmes of more than 5000 MWe, like Ontario's present capacity. A larger number, perhaps ten or fifteen countries, may have up to a few thousand megawatts.

Countries seem to consider nuc ar power as one among a range of alternative sources of electricity. The presence of other sources does not eliminate nuclear power, although it tends to keep the nuclear programmes smaller than they would otherwise be. The absence of other sources does not mean that nuclear power is absolutely indicated, although it represents a fairly strong inducement. Nuclear power will make a modest contribution to the overall energy supply in most countries where it is selected. In some large cities, and in some of the smaller, more industrialized countries, its contribution to electricity supply could be very significant.

Our study ignores international and domestic politics, leadership, institutions, promotional efforts of suppliers and competitors, the evolution of perceptions of technology in development and of nuclear power economics, and the fine structure of energy supply and demand. It is interesting that an energy policy approach using such broad statistical indicators has as much explanatory power as it does. It cannot explain in detail the presence or scale of nuclear power programmes in a given country, but it seems at least to be broadly consistent with the facts to assume that countries make their nuclear power decisions in rational energy-policy terms.

V. ETHICAL IMPLICATIONS

Several ethical questions emerge from this brief look at nuclear power in the developing countries.

1. The first is about disparities in energy consumption on a global scale. The developing countries need more energy. There is an ethical obligation

to help them achieve at least a minimal acceptable standard of living for their people, and energy is essential to their developmental goals.

Their basic need right now, as far as commercial energy is concerned, is oil. Using less ourselves would be one contribution. Helping them to find more, to use less or to use it more efficiently would be another. Helping them to diversify their energy sources, from efficient use of renewables through nuclear and other advanced forms would also be useful.

Oil is the most international form of energy, and the present distribution of oil consumption and oil revenues is perhaps a measure of the degree to which moral concerns dictate international politics. The results suggest that we do not live in a very moral world.

2. The second question is also distributive, but internal to the developing countries. In the short term, nuclear power contributes more directly to the urban industrial sector. The ethical question for the governments involved is whether the overall pattern of investment achieves a reasonable balance as far as developmental goals are concerned.

3. In any exchange there are ethical obligations incumbent on both parties. These are easy to list, though sometimes difficult to carry out in practice. Deceit, corruption, and exploitation are present in many human activities. Nonetheless, it should not be unduly optimistic to suggest that arrangements could be made for the sale of nuclear materials and technology which are of mutual benefit.

For the buyer, the Boy Scout motto is apposite. They should be prepared to bargain effectively and to lay the appropriate foundations for any programmes they undertake. (Caveat emptor is a good slogan too.) They should consider the alternatives to, and the consequences of, nuclear power. They

should ensure that it forms a coherent part of their overall development plan. They should be especially prepared to deal with questions of health, safety, and environmental impact which may arise.

For the vendors, and the countries they represent, honesty about their product and consistency in their policies are obvious ethical responsibilities. The developing countries who buy nucelar power are investing a large amount of their scarce capital in nuclear systems. They have a right to expect continuing co-operation in the management of such systems and continuing access to the nuclear materials, technology, equipment, and technical assistance they may need to ensure safety and good performance.

4. While commercial vendors, whether of stoves or nuclear reactors, are more interested in selling their wares than in formulating energy policy, the industrial countries have a responsibility to ensure that a broad range of energy technologies and of technical advice is available. Undue promotion of one technology may be as harmful as denial of another.

5. The suppliers should recognize that developing countries have a legitimate concern about autonomy, and that they will want to achieve as much indigenous control and technical capability over the nuclear fuel cycle as they can. By itself denial of technology is likely to be counter-productive.

At the same time, the developing countries should recognize that many people in the supplier countries are concerned about the possible misuse of civilian nuclear power programmes for military or terrorist purposes, and that a nonproliferation regime which guarantees continuing access to peaceful uses of nuclear energy, while minimizing the threat of their diversion to destructive purposes, is in everyone's best interest.

Because of some of the risks it represents, it may be necessary to demand a higher standard of morality in nuclear power affairs than in other activities. But such high moral standards in nuclear policy cannot accomplish much in isolation. What happens in the developing countries will depend more on the ethical nature of major political decisions and actions than on the particular technology they use to generate their electricity.

I would like to conclude with a general observation about our obligations to posterity. The most lethal instruments we leave to succeeding generations are not our technologies but our chromosomes and our human cultures. The diversity of life and of human intelligence opens a range of possibilities which includes, at one extreme, the starkest and most tragic outcomes. In choosing to continue the human adventure, we implicitly accept that risk. But this is not to say we must resign ourselves to a continuation of the chaos and violence to which, among other things, human history is witness. It simply reinforces what we already know: that as a species we cannot escape the consequences of our actions, and that we must make our decisions and act on them as wisely and as humanely as we now know how.

FIG. 1 Urbanisation vs. GNP

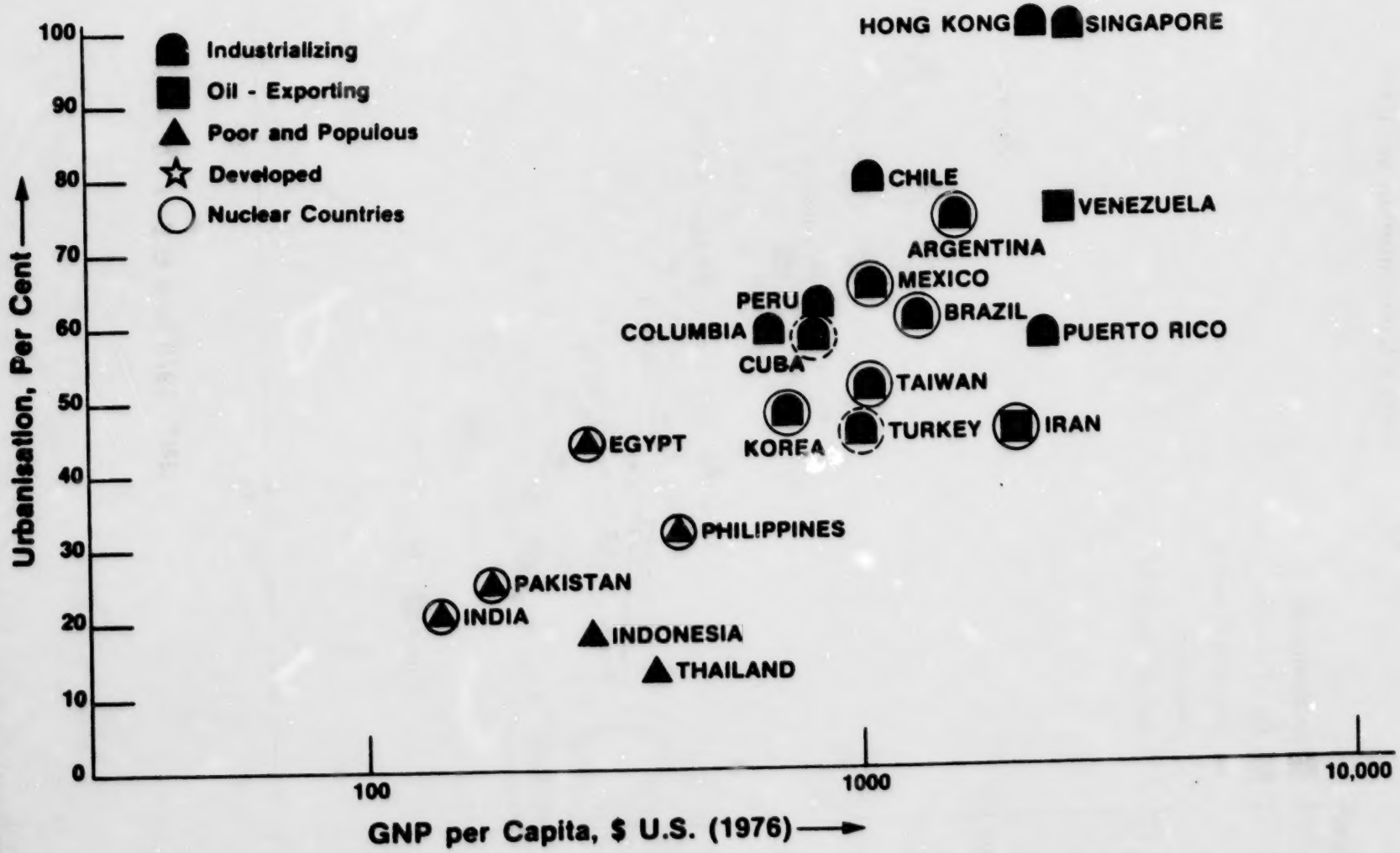


FIG. 2

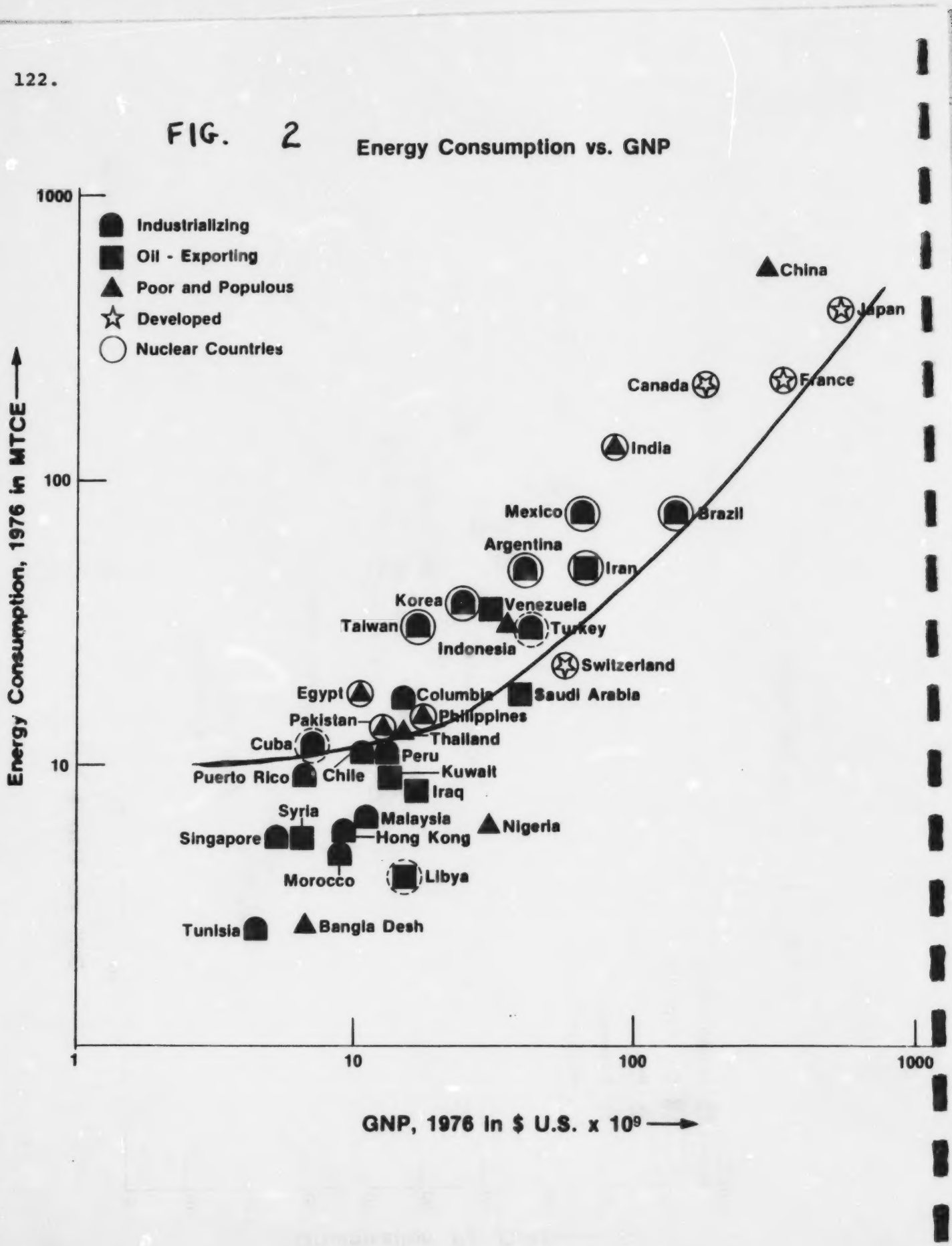
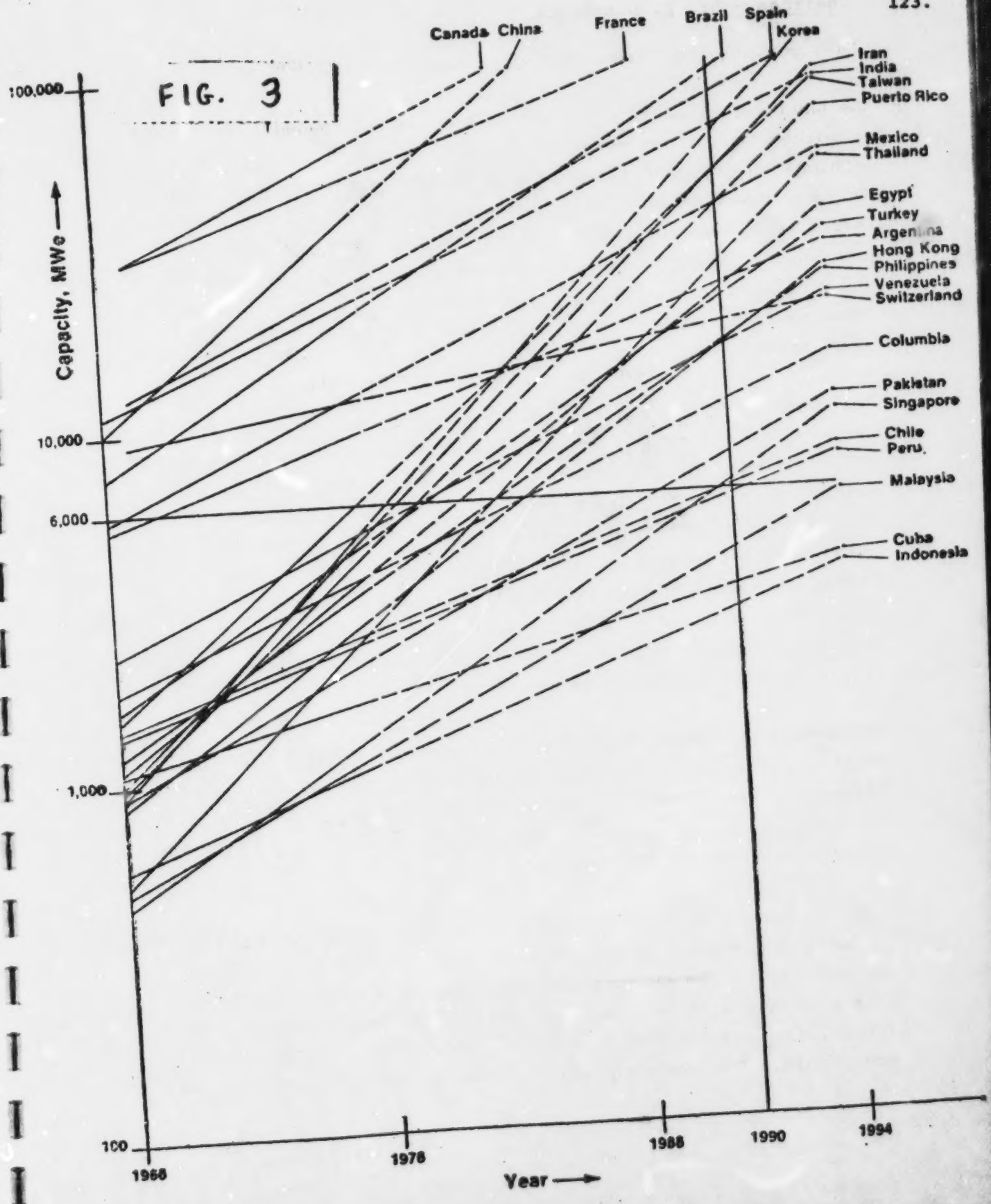

Energy Consumption vs. GNP
Industrializing
Oil - Exporting
Poor and Populous
Developed
Nuclear Countries
Energy Consumption, 1976 in MTCE
GNP, 1976 in $ U.S. x 10⁹
1000
100
10
1
10
100
1000
China
Japan
Canada
France
India
Mexico
Brazil
Argentina
Iran
Korea
Venezuela
Taiwan
Turkey
Indonesia
Switzerland
Egypt
Columbia
Saudi Arabia
Pakistan
Philippines
Thailand
Cuba
Peru
Puerto Rico
Chile
Kuwait
Iraq
Syria
Malaysia
Nigeria
Singapore
Hong Kong
Morocco
Libya
Tunisia
Bangla Desh

FIG. 3


Canada
China
France
Brazil
Spain
Korea
Iran
India
Taiwan
Puerto Rico
Mexico
Thailand
Egypt
Turkey
Argentina
Hong Kong
Philippines
Venezuela
Switzerland
Columbia
Pakistan
Singapore
Chile
Peru
Malaysia
Cuba
Indonesia
100,000
10,000
6,000
1,000
100
Capacity, MWe
1968
1978
1988
1990
1994
Year

Chairman - Dr. D. Hitchcock

That you, Dr. Morrison, for that comprehensive presentation.

We have now heard an overview of the social and ethical issues involved in nuclear power generation, a basic discussion of ethical theory, and three papers dealing with specific aspects of nuclear power generation. These presentations should provide sufficient background for the workshop discussions this afternoon. The proceedings of this conference will give unattributed summaries of these discussions, so you should feel free to risk tentative comments without fear of having to defend them later.

The first workshop concerns obligations to future generations, an issue which was raised by both Jan Narveson and Andy Brook, and which affects several phases of the nuclear fuel cycle. The primary question for discussion is whether we have any obligations to future generations and, if so, whether they are of equal weight to those we have to the present generation. The leader of this workshop is Robert Gaizauskas, holder of an M.A. from Carleton University and author of a report prepared for the Atomic Energy Control Board on the philosophical basis of our responsibility to future generations.

The second workshop, entitled "Theological Considerations", relates particularly to some of the points made in Peter Hamel's address. It will be chaired by Dr. Douglas Jay, director of the Toronto School of Theology. Dr. Jay has written on rights and responsibilities in the energy field.

The third workshop concerns risk assessment, a process involved in designing reactor safety systems and a subject of great controversy in the nuclear debate. The fundamental question in this workshop will be the construction of a reasonable model for determining whether the risks of a given course of action are acceptable. The workshop will be led by Dr. Terry Rogers, who

teaches mechanical and aeronautical engineering at Carleton University and also acts as a consultant to the Atomic Energy Control Board on reactor safety problems.

The fourth workshop deals with the possible conflict between reliance on sophisticated technology, such as that found in nuclear reactors, and social and political ideals. It will be led by Dr. Leslie Shemilt, professor of chemical engineering at McMaster University and a former dean of its engineering faculty. Dr. Shemilt is chairman of the technical advisory committee of Atomic Energy of Canada Limited on the nuclear fuel waste management program, and also chairman of the task force on energy of the United Church of Canada.

OBLIGATIONS TO FUTURE GENERATIONS

Workshop No. 1
Mr. R. Gaizauskas

The workshop began with Mr. Gaizauskas suggesting some topics for discussion. He provided the 17 participants with a handout sheet listing four questions to be used to guide conversation during the session.

The first question was the most general or theoretical in nature. "Do we have any obligations to future generations and if so what is their nature?"

Two sub-questions may also be considered depending on the extent of one's skepticism:

(i) "Are we prepared to allow obligations towards our contemporaries but doubt that these extend to future generations?

(ii) Do we doubt the existence of any obligations at all, even to our contemporaries?
(Clearly if self-interest is our only guide then there is no need to take the interests of future generations into account.)"

The other questions were as follows:

2. Assuming that we do have obligations to future generations are these obligations limited in any way?

   (i) Should future interests be discounted because
   (a) they do not yet exist?
   (b) they are liable to be dissimilar from our own in a fashion which renders them less morally significant?

   (ii) Does uncertainty, lack of knowledge, about whether our current actions will help or hinder future generations relieve or limit our obligations to future generations?

   (iii) Do obligations to our contemporaries limit or even supercede our obligations to future generations?

3. Can a moral obligation equation or decision procedure which takes the interest of future generations into account be worked out in order to provide the theoretical basis for deciding how to act with regards to a given proposal? If not, what are the residual conceptual issues?

4. Assuming some decision procedure is obtainable, what is the outcome when the procedure is applied to the propsal that full scale nuclear energy development be undertaken? If no outcome is obtainable what are the residual factual unknowns?"

Mr. Gaizauskas then sketched one possible response to the first three questions assuming a utilitarian viewpoint. Utilitarianism maintains that our fundamental obligation is to produce the greatest amount of happiness for all mankind. Despite the limitation of our uncertainty about what the future holds, if we adopt this position we must accept responsibility for future generations because there is no temperal reference in this belief. Some of Henry Sidgwick's comments on this subject were quoted.

Mr. Gaizauskas then suggested as a thought experiment, an equation that could be used to determine which course of action would bring about the greatest balance of pleasure over pain for all mankind. He pointed out the importance of determining possible consequences of a course of action before attempting to determine the cost.

Let $_{i \ldots N}$ represent the possible moral consequences of a proposed action X.

Let P_1 represent the probability of $_1$ occurring

Let a be the fundamental unit of moral worth (of pleasure or pain).

Let m_i be the coefficient of moral worth associated with the possible consequence of $_i$.

Then the present moral cost value of X is

$$C(X) = pm_i a + p_2 m_2 a + \ldots pNM_N a$$

At this point the workshop was opened up for discussion. Some participants expressed their displeasure with the equation and their concern that this approach seemed to be "theoretical talk" about utopia. Mention was made of problems resulting from acceptance of scientific and engineering equations as absolute and the inherent danger of acceptance of any equation as "the one". Later comments expressed the opinion that the use of this type of methodology was beneficial in that it forces you to identify parts of the equation such as the consequences of a certain action. However it is necessary to guard against allowing this type of procedure to become an excuse for inaction.

Another participant questioned whether it is possible to separate future obligations from actions we undertake to benefit ourselves because often there is an overlap. It was also suggested that nuclear energy will be merely a small ripple in the course of history when evaluated in terms of the millions of other factors that may affect the future. It is possible that we have a capacity today to influence the future more than was ever possible before?

It was suggested that some of the terms of the equation are subjective. Mr. Gaizauskas responded by saying that either we throw up our hands in the face of "intangibles" or else we investigate the possibility of an objectively defined fundamental moral unit. Mr. Gaizauskas critisized cost/benefit analysis because it places a dollar value on human life without in turn considering the moral value of the dollar. Debate ensued as to the purpose of cost/benefit analysis.

Mr. Gaizauskas made a final comment for consideration. He asked whether it is possible to associate directly a dollar value with actions, the consequences of which affect the happiness of people; does having twice as much money necessarily mean having twice as much happiness? There was no time left to pursue further discussion.

THEOLOGICAL CONSIDERATIONS

Workshop No. 2
Dr. D. Jay

For Christians and other religious persons, ethical decisions are ultimately based on a theological understanding of the faith of the religious community.

Theological Concepts Relevant to the Nuclear Debate

Creation, Nature and Human Dominion. There is no semantic equivalent in Old Testament Hebrew for either the modern concept of nature or the ancient Greek concept of physis. What is clear is that God creates nature, but is not equated with nature as in some other religious traditions. On the other hand, God is not remote from nature but continues to be involved. He relates to each of his creatures in an appropriate way: the earth, plants, animals, humanity. Humanity is at the head of the earthly community and is given dominion over the earth, but the earth remains the Lord's and man is the Lord's steward. The relations of all creatures to God are set within the framework of a convenant, made with all flesh and with the earth itself, in which God promises stability to existence.

Sin and Alienation from Nature. In spite of God's enduring creativity, sin and alienation have entered human life. Men are inclined both to act unjustly toward their neighbours and to exploit nature for selfish purposes, thus alienating themselves from God.

The Goodness of Creation. The overwhelming conviction of both the Old and New Testament is that the created order is God's work and therefore good. It is fallen, but God has acted in both the old and new convenant to provide for redemption. The New Testament relates the gospel hope of redemption (salvation and liberation through Jesus Christ) not only to humanity but also to creation as a whole.

Theological Implications for our Relation to Nature

1. For biblical writers, God is sovereign, and the earth is the Lord's, so that no human being can even own the earth outright but must be regarded as a tenant or steward responsible to God.

2. Under this overall sovereignty of God, man does have a position of control over nature, which is meant to be exercised in a spirit of respect and responsibility. Skills and technology may be admirable, but the greedy use of human power over nature derives from sin, not from God's intention in creation.

3. Man's proper control over nature derives from the belief that God is one and supreme; therefore the earth is neither divine nor demonic, and man is in a position to use his powers rationally in dealing with nature.

4. Nevertheless, nature is not to be valued simply in terms of human needs or wants. Technology may explore and exploit nature, but the truly wise man never imagines that he knows fully what God intended in creation.

5. Since God, however, has a moral and rational character, man may regard things as they are as a form of revelation as far as we can understand it of ultimate goodness and wisdom. We must have respect for the intricate character of the natural order, and if we do, we may hope even to improve the conditions of nature, which does not as yet embody God's character as human beings have come to know this through their communion with him. Nature is not perfect; there is a work of salvation to be done in her, as well as in humanity, as part of God's ultimate purpose, and this salvation is part of man's responsibility for her.

6. Christians believe that this ultimate purpose as well as God's present will for man is revealed in Jesus Christ. Through him, we understand God's love for man and for all creation. This is the basis for a Christian understanding of justice, responsibility for the neighbour and responsibility for the earth.

Implications for the Energy Debate

Recent Christian thinking about the implications of theology for the energy debate has led to the affirmation that we should strive toward a society that is just, participatory and sustainable.

Justice requires criticism of the vast inequalities in access to energy, both within most societies and between the rich and poor societies of the world. The sharing of resources and technologies is a moral demand. Justice may require sharing risks as well as benefits. In any energy system, it is unjust to maximize cheap energy by imposing exorbitant risks on an exploited group.

Participation requires new attention to the way in which people share in the decisions that effect their lives and welfare. This has particular application to the development of nuclear energy, both with respect to the hazards of its production and the disposal of waste, and the threat of proliferation of nuclear weapons.

Sustainability is a concept that relates both to our stewardship of the world's resources under God, and the demand for justice.

So long as there were illusions about unlimited cheap energy, the privileged could pretend that they did not need to share their wealth because others could acquire wealth by imitating them. To sustain human life on this planet now clearly requires conservation of non-renewable forms of energy, certainly in this period of transition from dwindling energy resources to new sources. Sustainability requires foresight and planning, on the part of individuals and societies involved, to provide renewable sources of energy. Fundamental questions must be raised about our lifestyle.

The following ethical questions need to be asked of every energy technology in considering its national, regional and international implications:

- What is it intended for?
- What damage or risk does it impose upon people and nature, particularly in comparison with alternatives?
- How does it promote or threaten human freedom and community?
- Can it be so used that its benefits will be distributed equitably?
- Will it benefit some and harm others, or will only those who benefit bear the financial, social, physical and environmental costs?
- Does it require great concentrations of political and economic power, and if so, how can that power be held accountable?
- Does it enable people to participate responsibly in the decisions that affect their own welfare?
- In what ways does it benefit or harm future generations?
- In what way does the mentality associated with the use of the technology affect the self-understanding and world views of people?
- In what ways does the use of the technology affect human rights and religious and ethical convictions?

Highlights of Discussion

1. Interpretation of Basic Theological Concepts

The basic theological concepts are subject to different interpretations at different times in history. One hundred years ago the development of the earth's resources was encouraged by the Christian Churches. However, today the stress is on limits to development. Are the theological concepts then simply a reflection of the times?

It is useful to consider how ideas are communicated and received. We find an evolution in our ideas and theological concepts due to new scientific insights, changing circumstances and recent improvements in communication through electronics. For example, today we understand that the earth has limits to its ability to disperse safely many of the unwanted products of humankind. There is a better understanding of ecological impact and we are more aware of impacts elsewhere as they occur, the drought in the Sahel, an oil spill off the coast of France, etc.

Our set of beliefs is dynamic and changes. This is not a change in basic thrust but rather a change which is evolutionary. A better understanding of nature permits a better understanding of the appropriate application of basic theological concepts. Theological interpretation is dynamic and must be so in order to remain relevant.

2. Technology - Demonic or Redemptive

There are two opposing and conflicting ways of viewing technology in general and nuclear power in particular from a theological perspective. One is the demonic interpretation, the other is the redemptive.

The demonic interpretation sees technology as essentially evil and going against the wishes of the Creator. Nuclear power is seen as a Pandora's box which should never have been opened and should now be closed as soon as possible; there are certain things in nature which should not be tampered with and this is one of them.

The redemptive interpretation views man as steward of nature. The responsible exploitation of nature may be redemptive. The development of a technology such as nuclear power is viewed as being beneficial as long as it is done in a responsible way with due regard for the welfare of all persons affected, ecology and justice. Some countries need an energy source such as nuclear power in the short term in order to allow them to develop. The sharing of nuclear technology between developed and developing countries may be the most responsible action to take.

There is a continuing dialectic between the positive and negative views of technology. These opposing views are found throughout society and also within the churches. Theologians have adopted the full range of positions.

The resolution passed at the World Council of Churches Conference "Faith Science and the Future" (held at M.I.T., July 1979) on a five-year nuclear moratorium was arrived at by some 500 participants coming from both the scientific and the church community. The dominant view was that of nuclear power as demonic. However there were many conflicting views. The statment that came out of this conference should not be interpreted as representing the Churches of the world. There were as many scientists as theologians, and even the theologians were not there as church representatives but as individuals.

Our decisions regarding any technology are not made in a vacuum. Our decisions affect others. For example, the decision to not allow uranium mining in British Columbia may have an impact on another country which may need that uranium. Our decisions should be made with a view to ensuring justice.

3. Participation

The question of participation was discussed briefly. All sections of society should be informed and should have the opportunity to express a judgement.

Participation may lead to selfishness in that each individual is out to protect his or her own interests. The problem with participation is to achieve a balance between the good of the individual and the good of society at large. Who speaks for society at large? Is it the institutions of government, or the Churches, or interest groups? Is there not a problem with groups or institutions tending to overpress their own cases.

There is clearly a need to question everything we do and to ensure that each individual can participate in making decisions which ultimately affect the whole of society.

RISK

Workshop No. 3
Dr. T. Rogers

The purpose of the Workshop was to bring together representatives of AECL, the nuclear industry, various utilities, churches, the academic community and other concerned parties to discuss relevant issues in risk assessment as they relate to nuclear power generation.

Introductory Remarks

Dr. Terry Rogers, the workshop facilitator, opened the session by handing out and discussing a paper synopsizing some key research findings, hypotheses and issues concerning risk assessment. This introduction included the following points:

- that risk assessment should necesssarily include an assessment of benefits
- that the research of Starr and others is useful in defining cognitive aspects of risk perception. Further, that such research raises questions concerning the nature of the gap between "real risks" and "perceived risks" and concerning the role of institutions affecting this gap.
- that the question "how safe is safe enough?" should be defined
- that there is general agreement among medical experts that radiation risk during the operation of CANDU reactors is negligible
- that world-wide reactor operation experience and various studies indicate that nuclear power generation has less risk both of accident during operation and of harm during the entire fuel cycle than coal-fired power generation
- that further methodological development in risk assessment is undoubtedly required
- that human intervention or error (cf. TMI and Brown's Ferry incidents) is an important consideration in risk assessment
- that there is an implicit but often objected to assignment of dollar values to a human life in the calculus of risk, and that there may be optimum levels of expenditure on nuclear safety requirements (above which it would be more productive to direct resources to riskier non-nuclear activities)

Ensuring Discussion

After Dr. Rogers' introduction, an argument was presented showing a saving in human lives through the increased use of nuclear power in Ontario. This argument was based on the assumptions that an increment in electrical generation causes an increment in Gross Provincial Product; that there is also a multiplier affect to such increases in GPP; that increased dollars spent on health care saves lives; and hence that increments in power generation produce increments in saved lives through increased expenditures in life-saving activities (as a constant share of an expanding "fiscal pie" would allow increased health and safety expenditures). The speaker concluded by stating that such fundamental factual arguments should be addressed first in any 'pro' versus 'anti' nuclear debate before more abtruse moral questions are tackled.

This view of the life-saving benefits of increased nuclear power generation was, in turn, contested on several bases including the contention of: marginal returns to health and safety expenditures; the absence of a causal relationship between energy production and the GPP; the "opportunity cost" of using scarce capital for increased power generation; and the inappropriateness of data sources used in support of the life-saving benefits argument.

The Three Mile Island incident was put forth as an example of the frequent cases of discrepancy between actual risk to the public and risk perceived by the public. It was stated in discussion that the actual risk to the public was low but that the public perceived considerable risk and did so for a variety of non-rationale reasons, including an absence of trust in authorities. A further point was made that there is a divergence in the technical expert's approach to risk assessment and the layman's approach - and that the former does little to inspire public confidence in risk estimates or to allay fears of harm. The discussion proceeded with a question about whether, on the basis of "actual risk", we have overdesigned reactors (the TMI incident was suggested as a case in point demonstrating inherent reactor safety). Further, the approach of the courts and insurance companies in assigning dollar values to life was suggested as a successful model for approaching this task in risk assessment. A philosophical speculation was made about whether a more realistic perception of statistical risk assessment would be made by the public if people held a more realistic perception of their own mortality (or absolute statistical certainty of eventual death).

During the workshop, participants cited a wide range of common problems and observations, including the following:

- that use of numbers in quantifying risk tends to imbue reports with a mystique of precision and rigor - leading sometimes to 'reification' or 'deification' of results

- that the public, however, is generally unable to comprehend technical models
- that the public, for better or for worse, is generally unable to be rationale or utilitarian
- that the public demonstrates resistance to describing a monetary value to human life
- that a certain proportion of the public will always reject nuclear power because there is some risk - no matter how small - of a catastrophic malfunction or of radiation dangers in the fuel cycle
- that risk assessment should not be divorced from the design discipline; we may reach the limit of our abilities to assess risk but we must still proceed with power system design in accordance with our best technical judgements

At the same time, a number of yet unresolved questions were raised, such as the following:

- are there consistencies in the public view?
- are there intuitive public perceptions?
- how important is the element of volition to risk perception?
- to what extent do values and ethics explain public perception of risk?
- are there threshold points in risk perception?
- is a "low probability - high impact" event perceived as a bigger risk by the public than a "higher probability - lower impact "event"?

Underlying the workshop discussions were some central definitional issues concerning risk assessment and risk perception. The matter of defining the way different groups develop fundamental assumptions and ways of approaching the process of conceptualizing, perceiving, and reacting to risk was explored. It was speculated, for example that:

- the definition "risk = probability x consequences" could be enlarged and restated to read "risk = probability x utility"
- the "risk assessment-perception paradigm" could be defined to reflect other interpretations. For example, that "actual risk = probability x utility" or that "perceived risk = f (perceived probability x perceived utility, credibility of authorities... etc.)

- a key societal problem is that of poor communication between groups that hold conflicting models of risk (typically between scientists, designers, technicians holding a physical science-oriented or more empiric and deterministic models of risk and the lay public reacting with more subjective and less numeric models).

- an urgent challenge is to establish better communication between groups holding different risk viewpoints in order to gain a common ground, better understanding, and ultimately better design and acceptance of public projects.

THE TECHNOLOGICAL FIX

Workshop No. 4
Dr. L. Shemilt

Considering a number of problems related to what is termed the "technological fix", eg.,

1. Are social values and objectives, and/or ethical values really met by a technological solution?

2. Can we assert (in all cases) that a technological solution is a real solution, when it often (always?) breeds new problems on an increasing number of fronts?

3. Are "technological fixes" only productive of a greater material affluence which never "satisfies"? How and when do they contribute, on a total balance, to enhanced quality of life?

the workshop noted that many social objectives can be met, in part if not wholly, by technological solutions, but only in a dynamic sense of total systems - rather than engineering system - approach to social needs and social values. Technologists, therefore, have a need to communicate more adequately among the general public who many not have a technological/scientific background and may not appreciate dynamics of technological/scientific solutions breeding new societal relationships or repercussions.

There were some general comments with regard to the rate of technological change, that in some instances the rate is not fast enough in terms of the needs of certain societies and certain parts of the world and perhaps too fast elsewhere, yet in either case, being economically/socially/politically driven. Again the very nature and complexity of technology implied an inter-disciplinary team approach.

Concern was expressed about the total bequest to the future that society makes in realizing technological solutions, eg, technological fixes, which can lead to both good and bad results, and that by tomorrow what is today a problem may be solved and will have reaped new percussions.

In summary, there was a certain amount of concensus that social organizations and their importance really lies in their being a "feedback" system as social attitudes breed new technological pushes, which in turn breed new social and societal relationships.

Chairman - Dr. D. Hitchcock

Our first speaker is someone whom it gives me a great pleasure to introduce, since he's a former teacher of mine, a colleague for the last eleven and one-half years and a former chairman of the Department of Philosophy at McMaster University, Sami Najm.

Dr. Najm is currently the Chairman of our Master of Arts/Master of Science (Teaching) program, as well as being Associate Professor of Philosophy. He has written on and spoken on topics in philosophy of education, the theory of value, and the philosophy of religion. He was for a year acting Dean of Humanities at McMaster University.

His topic this afternoon is "Technology and its Human Implications".

CANADIAN NUCLEAR ASSOCIATION

SEMINAR - MARCH, 1980

TECHNOLOGY AND ITS HUMAN IMPLICATIONS

- by -

S.M. Najm
McMaster University,
Hamilton, Ontario

The normal procedure in objective discourse is not to declare one's likes and dislikes from the outset. One is supposed to put these in abeyance in favor of unbiased facts, sound arguments, and impartial judgments. I am departing from this eminently reasonable approach, and I declare that I like technology, that I find it fascinating, and that, in spite of all its ill-effects, I am convinced it is essential to the human enterprise. I make this explicit statement in order to facilitate a critical assessment of my view of technology. My bias is clear but I trust it makes independent sense and is not a mere expression of taste.

Let me introduce my account with some general observations about the nature of technology. Because of the immense complexity and novelty of the things which modern science has enabled us to do or to make, we tend to forget that the essential structure of technology is simple. It consists of two components: a process and a product. As process it is constituted by more or less systematic procedures for performing certain activities or making certain products. As product technology consists mainly of tools, instruments, machines: that is, contrivances which embody systematic procedures or which can be used by human beings to carry these procedures out. The process and the product are obviously interdependent, but they are not the same thing. The process is to a large extent a possession of the human mind, a part of knowledge which is subject to our control. Within limits, we have a choice whether to make use of it or not, to implement it or not. Technology as a product,

however, assumes a life and efficacy of its own. In principle, it too is subservient to human commands and apparent control. Nevertheless, as tools and machines technology sets limits to its human creators and confronts them with compelling demands of its own. One of these is absolutely critical to the understanding of technology and its human implications as well as to the intelligent management of it. From the simplest tool, a knife for example, to the most complicated machinery of space travel, technological products invariably generate demands for other technological products. When we use a knife we soon discover two things: we become dependent on its continued use and its continued use requires that it be sharpened. The latter discovery is in effect a demand for sharpening techniques and tools and hence a new technology. It is as if all the lifeless artifacts and by-products of human creativity were not lifeless at all, but almost endowed with a power to reproduce and perpetuate their species. It is also as if this reproductive drive were governed by patterns not unlike those or organic nature with all its cycles. I do not know whether anyone has described a technological cycle; if not, it is as worthy of attention as the ecological cycle.

I will return to the above-mentioned reproductive drive, but first some more comments on my preliminary understanding of technology. In its simplest sense, therefore, it consists of know-how and tools. In this sense, it is as old as mankind and as variable and extensive as human activities. Both of these facts are important to recognize. It is a mistake to identify technology exclusively with the tools and machines and know-how of the Twentieth Century. Computers and cars are indeed relatively novel products, but they are descendants of man's long and complex tool-making history. Nor was primitive technology altogether different from its modern offspring. For example, although much of it was focussed on primary tasks

such as the provision of food and shelter, the facilitating of movement, and the waging of war. It did not neglect secondary directions whether in the making of products for recreation and sport, aesthetic satisfaction, or intellectual curiosity. It was not centered exclusively on means of survival. The making of musical instruments is probably as old as the making of spears for hunting and certainly older than the wheel. In short, in spite of its complexity and sophistication, modern technology exhibits essential continuities with its primitive ancestry. We are still concerned with the provision of food and shelter and the waging of war, and our secondary technology is different only in degree and scope, but not in kind.

It is also a seriously mistaken tendency to identify technology exclusively with certain human activities and the products and know-how which are associated with them. Ordinarily we are inclined to identify it with the design and manufacture of things which stand on their own, obviously apart from us as their creators. We readily admit, for example, that cars, computers, and nuclear plants are technological products. They are common examples of what I shall call manifest technology. Their composition and utility are primarily and distinctly physical. On the other side, we are not likely to think of legal codes, language systems, medical practice, or works of art as technological products or know-how. Why not? I do not believe there is any good reason to think of them as different in kind from the other products or processes of human intelligence and creativity. They constitute what I may call a latent or hidden technology whose characteristics and functions are not unlike those of manifest technology. For example, language is as much a tool, as much an entertaining and aesthetic object, as polluting and certainly as dangerous as a car. The proper and intelligent use of it is also as much a craft as making or repairing cars. Furthermore, those who blindly revere and mystify works of art

forget that they too are products fashioned from certain materials in accordance with more or less determinate procedures. Finally, legal practice is not essentially different from electrical engineering, even though its know-how is in the use of language and legal codes, rather than in the use of generators, wires and circuits. In the same way, medical practice is no less a technology than producing electricity from uranium.

The point I am trying to make is really simple, and I believe sound. To begin with, I am not trying to deny or dismiss the differences between the processes and products of manifest and latent technology. Clearly they deal with different materials, attend to different needs, and engender distinct problems and dangers. Different people also attach different degrees of importance to them and may be more suited to work in one rather than the other. Nevertheless, in all human activities which involve the methodical application of knowledge to the world, whether physical, mental, or social, there is technology as both products and know-how. The only activities which ought to be excluded are probably those which appear primarily instinctive, such as eating, drinking, sex, and certain passions which lack predictable order or deliberate direction. Otherwise, there is no sufficient reason to separate fundamentally the products and processes involved in manifest and latent technology.

Technology is an outward projection and determination of human character. Please note that I am saying it is both projection and determination. This means that it is in part an expression of what we are. It reflects our abilities and powers, our needs and interests. At the same time, it also shapes and fashions our character as human beings. It is part of what makes us what we are. It does this by combining our abilities and powers with the external world. It seeks and

brings about a union between us and the vast and various domains of physical, mental and social nature. In this process there is interaction and adjustment, not a one way determination or imposition. We are modified and determined by technology, just as the external world is modified and determined by it. Apart from technology, both we and the world are equally indeterminate.

One of the most pernicious patterns in the attempt to understand human beings and human life is what we may call the compartmentalization syndrome. It is the pervasive tendency to "pigeonhole" distinguishable facets of human activities and character and to deal with them as if they were entirely independent of each other. We find it in politics and education, just as we do in philosophy and in technology. It is an understandable tendency because human beings and human life are too complex to deal with as wholes. It is much simpler to concentrate on the parts of which they consist. However, the syndrome is not any the less pernicious because it is understandable. Firstly, it is pernicious because it is mistaken and distortive. Human beings and human life are full of continuities and interdependencies in spite of the conflicts with which we are familiar between the physical and the mental, the social and the individual, the moral and the economic. Second, the compartmentalization syndrome is pernicious because it gives the illusion of being intelligent. It does this by promoting specialization and one-sided expertise. The specialist or expert in a restricted area is important and useful but only on the condition that the good he serves in his field is not offset by the harm he causes outside it. In short, narrow specialization is far from intelligent if it is obvious to things outside its contrived boundaries. Third, compartmentalization is pernicious because it is difficult to counteract. It is not easy either to argue against expert opinion or to bring different

experts into dialogue with each other. Yet, both of these are frequently necessary or desirable.

I have a double-barreled reason for the above digression. On the one hand, it is addressed to experts and specialists in all fields. On the other, it is specifically intended to support my understanding of technology and its human implications. One of my worries is that technology has been a victim of the compartmentalization syndrome. It is "pigeonholed" and usually interpreted or criticized exclusively in terms of only one of its features or functions. The syndrome is pernicious in this case too and we ought to get rid of it by recognizing at least three distinct but complementary functions of technology.

1. The Utility Function of Technology

There is no doubt that the dominant and pervasive manner in which technology, whether manifest or latent, is interpreted, defended, or attacked is in reference to its usefulness. There is little doubt either that technology is extensively useful. It is the means whereby mankind attempt to secure their survival and comfort in the world. And if you agree that what I have called latent technology is indeed technology, then the utility function pertains to human life in all its facets and directions.

With regard to its utility, technology is evaluated by means of a cost-benefit accounting which is entirely appropriate in individual cases or in limited operations. Whether in the development and production of energy, a new car, or the organization of a school system, the utility of technological processes and products is defined as the excess of benefit over cost. Obviously this does not say what is to be

included in the costs or benefits, and consequently, this kind of accounting often creates controversies even though it appears simple. It does provide, nevertheless, a formula for measuring profitability. The use of it requires considerable care and repeated refinements, but it is absurd or dishonest to think that we can ignore it.

There are two general ways of interpreting the utility of technology. The more common one considers technology as positively conducive to human improvement. Not only does it facilitate our survival, it also contributes to our enjoyment of the life we live. In this sense, the need for technology is open-ended: provided there is a balance of benefit over cost, then the more the better. The less common approach thinks of the utility of technology as predominantly negative. It tends to restrict technology to the manifest variety and understands it as man's actions upon physical nature, actions which are designed to protect mankind from annihilation. Therefore, the need for it is minimal. It is legitimate only to the extent that it is necessary to prevent human destruction and death. When it goes much beyond this, it ought to be checked. Underlying this interpretation is a kind of romantic-religious conception of mankind which tends to deny the intrinsic worth of physical comfort and convenience. It sees them and all the processes and products of technology primarily as means to other ends. Human fulfilment is said to be found in spiritual life, the life of thought, or in social life, all of which are considered beyond the scope of technology. As to man's contention with physical nature, this view urges harmony and cooperation. It counsels that we ought not to attempt to control or subjugate it by means of technology. Rather we ought to confine our efforts to protecting ourselves against its extreme aberrations and ravages.

I reject the restriction of technology to its manifest variety

and the understanding of its utility as primarily negative. At the same time, it is dangerous to think of the need for technolcgy as open-ended in all cases. But I want to leave these issues aside. Instead I wish to point out that the analysis and interpretation of technology exclusively in terms of its utility function, whether negative or positive, presupposes that technology is essentially external, incidental, or adventitious to mankind. In other words, when it is not directly conducive to human comfort and survival, or when it does not protect mankind from the ravages of nature, it has no further value or justification. It ceases to deserve the investment of human and material resources, and it becomes both wasteful and dangerous. Its utility function is what impels mankind to develop it and sustains them in continuing to pursue it.

It is probably already implicit that I consider it a mistaken and one-sided view to emphasize exclusively the utility function of technology. Clearly, this is its most apparent feature, but it is neither the only one, nor the most important. To support this claim, in the following I will try to argue two points: that technology is not merely useful, but in fact intrinsically worthwhile, and that it is not adventitious but in fact integral to mankind.

2. The Aesthetic Function of Technology

If it is granted that latent technology is indeed part of technology in general, then it becomes obvious that many technological processes and products have aesthetic functions. In the use of language and in art the know-how and products involved are considered ends in themselves, not merely means. That is, we do not think of them always as useful, but often as intrinsically worthwhile, in themselves enjoyable to do or to have. This is what I mean by an "aesthetic function", namely that the value of something is in itself, rather than

in its being an instrument or a means to something else.

I will assume that the aesthetic function of much of latent technology does not need to be elaborated. But how are we to understand it in the case of manifest technology? Where is the aesthetic function in the making of cars, computers, or airplanes, or vehicles that can fly to the moon? To ask the question in the context of these things, especially with reference to their inventors and developers, is already to imply a positive answer. These products and the processes associated with them are not merely useful: they are, in fact, also in themselves, intrinsically worthwhile. They are objects of enjoyment, of aesthetic satisfaction quite apart from or even in spite of their useful function. The marvellous designs, the intricate connections and economies of parts, and the contrivances of causes and effects, to say nothing of the sciences and the logic embodied in them, are nothing less than profound works of art and objects of beauty. It is a very impoverished imagination ehich sees them only as tools.

However, when we ask the same question of other products and processes of manifest technology, the picture becomes significantly more clouded. Where is the aesthetic function, for example, in the making of nuclear weapons, poisonous gases, trash compactors, or even nuclear generators? Aside from the fact that I have a "thing", as they say, against the frivolousness and wastefulness of residential trash compactors, and that I share the general worries about nuclear technology, I think we have to admit that the aesthetic value of such things is at least questionable. In the case of dangerous things, their intrinsic worth is put into question by the very dangers, whether real or imagined, with which they confront us. Nevertheless, there are three points I would like to make in support of my contention that even these

products and processes of technology are pursued partly because of their aesthetic function.

First, I do not want to maintain that all technological things serve both the utility and the aesthetic functions in the same way or to the same extent. On the contrary, it is evident that this is a matter of degrees. Some things are obviously more influenced by and contribute more to one of the functions than the other.

Second, I am convinced that we do not readily abandon some of the processes and products of technology whose utility is suspect partly because an element of play is involved in our pursuit of them. We persist in them regardless of likely consequences because we find intrinsic worth and aesthetic satisfaction in the processes and products themselves. In comprehensive terms, technology is in part a form of human play, not only for individual producers or consumers, but also for mankind collectively. Fun is no less a factor than fruitfulness in our technological endeavours.

Third, it is obvious that human beings do not always play safely. Nor is it the case that they court danger and disaster only when there is a prospect of utility. We know all too well that there is considerable risk in professional as well as amateur sports, in mountain-climbing, as in skiing and car racing. There is also danger which may be much greater than we dare imagine in some scientific pursuits, in experimentation with new chemicals or drugs, or even in mass communications which may radically alter the character and behavior of human beings a few centuries from now. The possible consequences of these and many other human activities are as innumerable as they are uncertain. Yet it is unlikely that we will abandon them in spite of the fact that we are uncertain that they are safe, or that we are relatively certain they are unsafe. Nor do we persist in

them merely because we are irrational or perverse. We do so because we find them intrinsically worthwhile.

Cognizance of aesthetic satisfaction or play as an important factor in the sustenance of technology is necessary for the understanding of it. However, this does not entitle us to conclude that any and every aesthetic whim is sufficient justification for any and every technological activity. It is crucial to retain the ability and the sense to distinguish some forms and directions of technology as on the whole preferable to some others.

3. The Constitutive Function of Technology

I have already anticipated the thrust of what I want to suggest under this heading, namely that technology is essential, and not adventitious, to mankind. What I mean by its constitutive function is that in all its facets it is part of what makes us what we are. Technology is at once an expression and a determination of human nature. And if we include both its manifest and latent varieties, then it becomes the major expression and determination of human nature. I am not only saying that man is the tool-making animal. I am also saying that man is the animal which fashions and discovers his own nature in all the things he does and makes, from physical tools and machines to languages and legal codes. It is an essential feature of being human to act on both ourselves and physical nature to obtain sustenance and protection against the elements and to make sense of ourselves, to become fully human.

The constitutive function of technology has two fundamental implications. First, we develop technological know-how and products not only because they are useful or enjoyable, but perhaps much more because we want to find out whether we can develop them. The effort involved is more than a search for

profit in the ordinary sense and also more than an aesthetic fancy. It is a deep-rooted form of self-realization. Therefore, I think it is naive and superficial to criticize parts or all of it because their utility is not evident or because as individuals we do not happen to enjoy them.

Second, and similarly to the first, a common objection to technology, particularly of the manifest variety, becomes also naive and superficial. This objection alleges that technology has a dehumanizing effect. What this really means is that it modifies human character and behavior. To this extent there is no doubt about it. But to presuppose that there is a given, permanent, and noble human nature which is somehow sullied and demeaned by technology is neither sound nor plausible. Cars and computers are as much an expression and determination of human nature by human activity as are works of art or literature or social institutions. It may be that we ought to have more of one kind and less of the other; this is at least open to debate. But I do not think it makes much sense to talk of the dehumanizing effect of technology without qualification.

What I have tried to do so far is to indicate some of the major requirements of a proper and sound understanding of technology. I have argued that as processes and products technology is not restricted to physical tools and machines, but includes all human activities which involve the methodical application of knowledge to the world. I have also argued that technology is defined by utility, aesthetic and constitutive functions, and that each of these generates and is governed by its own distinct requirements and implications for mankind. I will conclude then by bringing together some crucial points which emerged in the above discussion.

The most serious danger of any kind of technology is that its processes and products may overtake and enslave their authors. I do not have in mind some fancy science fiction scenario, though it may be very much worth considering, but rather the "nitty-gritty" of daily life and worries. Technological processes and products, all of them, including languages and legal codes, enslave in at least two ways: we become increasingly dependent on them and they confront us with every expanding demands for more of the same kind. The latter is what I referred to earlier as the reproductive drive of technology. The threat it poses to mankind is that it will lead to a world of such fantastic complexity that madness becomes the simplest way to survive. It may not even be an exaggeration to say that the world has already been made too complex by human technology to be comfortable for many of us. Technological processes and products are threatening the very human freedom and creativity which generate them.

The situation demands that we bring sense and order into all our technological enterprises. Therefore, I propose that we consider a technological imperative of control. It says: You shall not permit technological processes and products to become your lord and master. You shall keep them in bondage to serve you, and you shall allow them to multiply only to maintain your mastery over them. At stake is the preservation of human freedom, the ability to think, feel, act and move more or less at will, or at least with a minimum of impediment from the things which we create. The constitutive function of technology requires that human beings retain the freedom to project and determine themselves. At the same time, there is no doubt that every product or process of technology limits this freedom to some extent. It is important to reiterate that even words impose such limits.

They come back to haunt us as we all know. So do our past feelings, thoughts, and actions. That much of our lives is constrained and determined by these human products is not an overstatement. They too can enslave us with all the forces of guilt, anxiety, and fear. Sometimes they are not so subtle or sophisticated. They get us into trouble, they make us lose our jobs, they lead us into quarrels and wars, and they may land us in jail.

The critical question, then, is: which of the limits imposed by technological processes and products do we tolerate and to what extent? And the answer is again control, but it is neither an easy nor always a clear answer. The technological imperative I have in mind is not unlike some formulations of the moral imperative. Kant, the 18th century German philosopher, understood the supreme moral rule to be precisely the expression and preservation of human freedom. His view may be interpreted as follows: In everything we say or do we ought to act freely as rational beings, that is, never from a desire or fear of consequences. We ought to be autonomous beings, masters of ourselves, allowing nothing to determine our actions except our own will to do the right thing. We ought to be in control, allowing neither passions, nor words nor things to determine what we do.

It is not easy to explicate Kant's view fully. Nevertheless, the connection between his moral imperative and what I have called the technological imperative is instructive. It indicates that in both cases we are in a position to decide what to do. Strictly we cannot abandon either enterprise. We can no more cease to be morally responsible than we can cease to be technologically productive. Nor can we blame what we do or what we become as human beings on anything ultimately but ourselves. We can only choose what we do in both domains. In technology this means that we have to

be critical and reflective in our pursuits particularly when their utility or aesthetic appeal appears to be overwhelming. We need to be careful to prevent our technological processes and products from undermining and negating our freedom and ability to control and to continue to pursue them.

Finally, there are probably only two possible ways to control technology. Either we control it with alternative technology or we attempt to abandon some of it altogether. The latter is very attractive especially to those who conceive mankind as fundamentally simple beings who can achieve self-realization along more or less narrow paths. I do not think this is a sound or workable option. Mankind are too complex and their self-realization is too variable for this view to be convincing. On the other hand, the control of technology with alternative technology does make sense. It means keeping our options open. When my electric drill has broken down, I have used a spiral nail and twisted it repeatedly with a pair of pliers. On occasion I have even heated a nail to burn a hole in wood where I would have drilled one. Trivial as these examples are, they do suggest that alternative technological options have the effect of reaffirming that we as human beings are the masters, not the slaves of technology. Identifying and developing technological options insure that our preferences for one kind or one direction are not dictated to us, but are in fact genuine preferences which we can critically and reflectively choose for ourselves as free human beings. To the extent that technological processes and products do not deprive us of this freedom, there is no compelling argument against them.

Chairman - Dr. D. Hitchcock

Thank you very much, Sami. You have given us a very instructive insight into the Promethean impulse which Dr. Pickering spoke about last night - an argument that the constitutive function of technology itself imposes a kind of limit on technology in terms of our freedom.

Our next speaker, Dr. Abbyann Lynch, is Associate Professor of Philosophy at St. Michaels College. She lectures on medical ethics in various divisions and faculties of the university including dentistry, medicine and nursing. She therefore has a particular engagement with the whole enterprise which has been so characteristic of ethics in the last decade.

Moral philosophers are beginning to apply some of the principles which are as you have seen sometimes very abstract and remote from daily practical problems to specific areas of human concern and specific areas of policy making.

Dr. Lynch is going to speak to us about this whole enterprise of trying to apply ethics to particular areas of human concern, to environmental questions, to questions of medical practice, and so on.

I give you Dr. Lynch on the topic, "Is the new Bioethics, Environmental Ethics, New Enough?".

A. Lynch, Ph.D.
St. Michael's College
Department of Philosophy
University of Toronto

Is The "New" Bioethics - Environmental Ethics New Enough?

To speak of today's exponential rate of development in scientific knowledge and technological capability is to say nothing novel. To cite development of bioethics and environmental ethics as new philosophical responses to such advances may belabour the obvious. Of more interest and more importance is whether these responses, seen as modifications of previous ethical methodology (thus new-old) can be sufficient for the task assumed. Stated differently, is contemporary scientific and technological activity to be seen by ethicists as a revolution of degree or of kind? If the former, an updated "old" ethics should suffice; if the latter, a radically "new" ethics is required.

How are bioethics and environmental ethics presently identified?

Despite the early meaning given the term by Potter (i.e. an activity directed to human survival by use of science), bioethics is now widely recognized as the philosophical discipline which examines the ethical aspects of scientific and technological activity. In so doing, its practitioners seek normative knowledge concerning the risk/benefits of given procedures; they ponder questions of human rights, obligation, decision-making processes against the background of the sciences' "new" facts and technology's potential and realized application of them. As an outgrowth of the perennial study of human values, bioethics may be said to have as its base traditional ethics modified by the need for newly-derived rules more appropriate to current scientific and technological developments (Clouser).

Environmental ethics is focused on similar questions of rights, obligation, decision-making processes raised in response to scientific and technological activities as they impinge on man's habitat. Whereas bioethics reflects on the human-ness of it all, environmental ethics is concerned with traditional value in the light of the non-human as well. Thus the environmental ethicists move beyond risk/benefit calculated only in human terms, e.g., to question risk/benefit in relation to the ecosphere as a whole; beyond questions of human rights and obligation to the question of the rights of non-human being. Fundamental to the outcome of this ethicist's theorizing will be the relation the ethicist perceives exists between man and the environment: those who argue man's respectful use of nature (Dubos) presuppose a stewardship relation; those who argue man's dominion over nature will propose a different set of human activities in the environment as suitable.

Both bioethicist and environmental ethicist come together in their approach to formulation of public policy, calling for increased attention to alternative action, social justice, concern for the future with unprecedented insistence. The "consumerism" and "public interest" groups as affecting public decision-making may be seen as progeny of these ethicists' activity.

New as these ethics may be (as species, they are relatively recent, age 30 - 35) and old as they may be (in genus, their ancestry spans 2500 - 3000 years), are they sufficient to the problems posed by contemporary science and technology? The answer must be both "Yes" and "No". Given the previous description of these activities, the question's answer is rooted in an understanding of what sciences and technology do or have the capability of doing: as has been noted, that is the genesis of these ethics' work, but there may also be some clarification required as to the adequacy of these ethics' tools even beyond perception of the difficulties just posed. At least four specific areas must be addressed:

i. Can these ethics generate an adequate data base?

ii. Given an uncertain data base in some areas of scientific

and technological activity, can these ethics function?

iii. Are these ethics adequate to totally new questions (e.g. "survival" as contrasted with "quality of life"; "human" life in humanly-modified form)?

iv. Are these ethics apt for use in the current clamour for ethical public policy guidelines regarding the matters of concern (are philosophers theoretically prepared for participation in political activity, directly or indrectly; can they/should they be)?

i. Contemporary bioethics, environmental ethics and the appropriate data base

It is insufficient for an ethicist to have "an interest" in these areas. On the assumption that these ethics deal with real (as well as theoretical) problems, an accurate data base is essential for philosophical reflection. In achieving this, two difficulties are immediately-apparent:

- the non-scientist's non-ability in this field makes dependence on "experts" inevitable;

- scientific and technological activity is not value-free. As described by the practitioner, this may not be recognized; the perception of the operative value-system by the ethicist may be incorrect.

Simple examples of the question here suffice:

- It may be that in community information services, scientific data is "tailored" to suit the company interest: this is not an unusual occurrence. How will the ethicist know the real state of the art?

- In a more "objective" situation, scientists' codes of practice may give "truth" pre-eminence (e.g., J. Monod: "The only goal the sovereign good, is not, we must admit, the happiness of man, even his temporal power or comfort, not the Socratic Know Thyself - it is objective knowledge itself. This is a rigid and constraining ethic which, if it respects man as the supporter of knowledge, nevertheless defines a value superior to man himself"); the ethicists' code may make "justice" primary. Do or can scientists describe accurately what is done in the light of both value-assumptions and scientific work such that the ethicists can correctly perceive the assumptions and the work? (Would two scientists working in the same area but with different value-assumptions not come to different conclusions? One might say, given his value-system, "Leave atomic energy aside - this is not good scientific work". Another, with a different view, proceeds, saying in effect, "Proceed with atomic energy - it is good science"). Can the ethicists really make relevant ethical observations without destroying the reality of the scientific activity described?

Consideration of this difficulty is essential in identifying the work appropriate to bioethics and environmental ethics today. How much "unfiltered" information have these practitioners in terms of "ionizing radition", e.g.? And if they do not have such fundamental information, how shall they get it? Would it be more appropriate to speak of "environmental ethics according to the information provided by the Canadian Nuclear Association" so that the underlying value-system is clear before the ethicist makes what amounts to be an adaptation of others' value-systems in presenting what he perceives to be his own? To reject this is to say two things: the new-old ethicists need far greater scientific knowledge before proceeding in their work. Perhaps these ethicists should be scientists first. The scientists need far greater ethical insight so as to recognize their assumptions and explain them as they are to non-scientists: perhaps they should be ethicists first. I suggest this approach to

the new-old ethics will be a difference of kind, not degree for the ethicists concerned. No longer can they wait on information; they must generate it. What appears similar to the old ethics here is preoccupation with value-system. What is fundamentally different is the immediacy and accuracy of scientific data required for such speculation. Indeed, a new-"new" ethicist is required.

Now it may be argued that even with this move, the scientific data or the ethical analysis will be skewed, human nature being what it is and "bias" an inescapable fact of life. Prior to this question, however, is our first query: will new-old ethicists perceive the necessity of shift in knowledge-base as a difference in degree or kind? Since the new-old ethical discipline will no longer suffice in its very root of knowledge, a new-"new" bio-science ethicist seems required. It would appear that a difference in kind of ethicist, not degree of practice, is required.

ii. Uncertain data base and ethical activity

The recent hearing on Recombinant DNA Experimental in the City of Cambridge before the Cambridge City Council June 23, 1976 and July 7, 1976 illustrates the difficulties inherent in certain scientific and technological activity when the data base seems unclear to all concerned, aside from value-assumptions made. In this case, debate centred on risk of damage, probability of benefit. It is one thing to argue "reality", another thing to argue "probability", particularly when there are different probability-theories and the "weights" assigned the essential ingredients in each theorist's use of any one modality may be different. That is what happened in the Cambridge hearing.

In such cases, is the new-old ethics adequate to the task? There is no doubt that valiant attempts have been made. In fact, however, the new-old ethics' ability to deal with uncertainty is no better than

the old. New "games-theory" attempts by new-old ethicists, e.g., require quantification of "quality" terms which many find unacceptable in principle, unworkable in practice. In estimating "cost-benefit" accurately, e.g., an attempt may be made to quantify the number of persons exposed to risk, the number of persons expected to benefit, the degree of risk/benefit in applicable cases. What of the individual's personal assessment of risk/benefit in non-quantifiable matters, e.g., family harmony, community peace?

It seems undeniable that in dealing with uncertain data, a new-old ethicists' attempt to rationalize, laudable as that may otherwise be, is out of keeping with ethics' role. A change in kind in ethics has occurred with the new-old ethics in this area: the new "new" ethics must reverse that change in kind, returning to its earlier mode, retrieving the true difference of quantity/quality. In this regard, a change in kind of the new-old ethics is required, one which re-instates a part of "older" ethics.

iii. Contemporary ethics' adequacy to new questions posed by scientific and technological developments

If, as some assert, we are at a point of "extremity of the survival issue" (Jonas), will the new-old "lifeboat ethics" be adequate? Can the new-old ethics deal with the humanly-changed-human? Is it adequate to questions of rights for future generations? Of course, the essence of the difficulty is whether the situations detected are really new in kind or just an escalation of degree? If the world were to be unlivable, this may occur by degrees, but surely it is a difference of kind from a livable world? If the environment is alleged to have "rights", this is different in kind from an environment in which "rights" are "human" only? If we create a human chimera, this is different in kind, not degree, from a human?

The new-old ethics would be of no value in some of these instances:

"agreement in favor of life is pretheoretical, instinctive, universal. Averting disaster takes precedence over everything else, including pursuit of the good, and suspends otherwise inviolable prohibitions or rule" (Jonas). Neither would any other ethics.

In dealing with "changed" human or environmental conditions, the new-old ethics may not be new enough. When animals and trees have "rights", the ethical guidelines must be different in kind since they were framed in a totally different context within which such rights did not exist.

The tendency has been to argue that the new-old bioethics, as an extension of the old in degree is adequate to this type of question. Without a change of kind, as many cases illustrate, this is not realistic and impossible in principle. A new "new" ethics of kind is required.

iv. New ethics and public policy

An observed and laudable contemporary phenomenon is the overt status given ethics in formulation of public policy (e.g., ethical consideration in formulation of guidelines for human experimentation - Medical Research Council of Canada; USDHEW). There is no question that practices which affect persons must have ethical underpinnings, that government decisions have a social justice component. Public policy and ethics are inextricably intertwined.

The question is whether the new-old ethics is adequate to the exercise. Again, there have been valiant attempts in this area, both by the discipline and by individual ethicists. But can knowledge of desirable action be a substitute for political activity? Can knowledge here be adequate without political expertise? On the contrary, can it not be damaging in the absence of such expertise? Can political expertise, exercised with "goodwill" and little ethical knowledge be helpful?

It would seem, again, that ethicists must somehow become politically-sensitized. If not partaking in the actual exercises, they must know what is apt in argument or political action: in the nature of their discipline, itself ordered to action, they are not so prepared. To ask their participation here is good; to participate without particular preparation may not be good enough.

This is to argue that the new-old ethics must become more new. If it is to achieve a rightful place in formulation of public policy, then ethicists must become more political, and this is a matter of kind, not degree. Within our present political reality, the increased participation of all citizens is required: ethicists, as citizens, are not excepted. Beyond this, however, to have the proper impact on public policy, ethics must be there, if not personally, then in the documents directed for such use. In either case, this extension of ethics' role is not a minor modification: it calls for a fundamental reassessment of proper ethicist-activity and preparation for it.

In summary, then, the new-old ethicists' efforts are praiseworthy, motivated by the demand of the discipline: scientific and technological developments do require comment and direction in the value-sphere. But motive and activity are insufficient. Critical examination of the new-old ethics is required. In non-ethical terms, a feasibility study is essential. Its object should be a determination of whether the new-old ethics has the capability of access and assessment for its appropriate data base; whether it can cope with new questions in terms of traditional guidelines; whether it is sufficiently political to be of use in the public arena. On first inspection, it would appear that more than formal change is required. New "new" ethics are required, a substantially-different discipline, one that varies in kind, not only degree, from its contemporary predecessor.

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Chairman - Dr. D. Hitchcock

Thank you, Dr. Lynch.

It now gives me great pleasure to introduce Dr. Martin Johns, who will be giving us his personal perspective on energy as a world problem.

He was born and grew up in China, where his parents were missionaries, and therefore has first hand exposure to what it was like to live in the third world.

Dr. Johns is Professor of Physics and Co-ordinator of Part time Degree Studies at McMaster University.

He has a Ph.D. from the University of Toronto and he is the author of over eighty papers on the nuclear properties of a wide range of nuclei. He has been an active member of the United Church of Canada and is currently a member of its Task Force on Energy.

He will speak on the topic, "Energy as a World Problem".

ENERGY AND THE THIRD WORLD

M. W. Johns

March 1980

My boyhood was spent in a highly cultured country with a per capita energy budget typical of that of Greece or Rome and perhaps fifteen times smaller than that to which we in North America are accustomed. The forty million people of Szechuan were supported by one of the world's most fertile agricultural areas and by a climate which made possible the harvesting of two crops of grain per year or three crops of vegetables. Nothing was wasted-- and no land was allowed to remain fallow. Every family had its own pig which built pork from the leftovers of the family table and the human and animal excretions all found their way back on the land to produce new rice and vegetables. There were no forests, because the land was too precious to be used in this way, and the main source of fresh fodder for the goats, and the beasts of burden (horses, cattle, buffaloes) were the cemeteries which also doubled as recreational areas for the children. Although the people of Szechuan had never heard of bio mass or gasohol or potato power, they would have thought that food was much too precious to be wasted on means of locomotion. After all, men and animals had legs which could get you thirty miles a day -- day in and day out.

Lest the romanticists among us--and there are many who sigh as Rousseau did for the life of the simple man--think that their lifestyle was better than ours, a few other facts need to be presented. The first fact is that at least a quarter of the population was perpetually hungry, and suffering from malnutrition.

Food in such circumstances becomes the compelling interest in one's life and it is no accident that the standard form of greeting throughout China is not "Good Morning" but "Tse Fan Mei Yu" or "have you eaten rice yet?" For many of those who operated the public transport system -- the wheel barrow men and sedan chair carriers -- morning rice became a possibility only after one had secured a fare and taken him to his destination. Starvation was an ever present fact of life and I still have vivid memories of the assault made on my eyes and nose by those who had died of it.

In 1977, about four million people in this world died of starvation and about two billion were perpetually hungry. We are not talking about the kind of hunger that we experience when we miss a meal or come late to the table -- but what Ghandi called "an eternal compulsary fast". People in such a state can dream of little else but food for their bellies. To us, who aspire to follow a Christ who came "that man might have life and have it more abundantly", the situation that half the world finds itself in must be regarded as scandalous and immoral. And it is related to our priorities with respect to energy.

My childhood memories were reinforced and amplified when I spent three months in Pakistan as a Colombo Plan "expert" during 1960. I saw again the same pitiful sights of children suffering from malnutrition, beggars whose parents had maimed

them because a child with one hand missing has a better chance of survival than one with two, and of thousands of people whose only shelter from the elements was the doorway of a public building.

One evening, I was taken by Professor Chandri, the director of the Lahore High Tension Laboratory to the Bazaar. An Asiatic bazaar is an exotic place, especially at night when the dim lighting hides the dirt and obscures the imperfections of the wares. Carried away by the mood of the place, I picked out some rings and brooches for my wife and our teenage daughters--only to discover when I reached my hotel that they had all been manufactured in England -- using the fossil fuelled slaves of mass production. Even at the current wage of 25¢ Canadian per day which was the minimum wage in Lahore, it was impossible to match the efficiency of the machines of the west. This simple example can be multiplied thousands of times over as we sell our energy-intensive but man-economic industrial products to the third world which has no energy to match ours. In this way, we export our unemployment, creating a high standard of living for ourselves and destroying opportunities for those of the third world. In the unequal struggle of the 35 years since World War II, the discrepancy between our living standards and those of the third world has widened every year as we have become richer and richer and they have become poorer and poorer.

The situation can be explicitly stated in energy terms-- The human animal, living off a food budget of 2000 kilocalories per day is using energy at the same rate as a 100 watt lamp. People can exist at the 50 watt level, and people doing heavy labor may require 150 watts but we may reasonably think of ourselves as 100 watt machines deriving our power from solar energy through the food chain. This 100 watts represents the basic need of survival -- whether we sit and think or just sit.

The societies of Greece and Rome had an energy budget of from 400 to 500 watts per capita -- an energy derived from renewable resources in the form of grains, livestock and trees. The societies of the third world today have roughly the same energy budget. Characteristic of all such societies is the presence of a very small but very rich aristocracy and a very large population of slaves, serfs or farmers who never get out of the hands of the money lenders. From the ranks of this group are drawn those who through illness, accident, drought or pestilence lose out in the struggle for survival and die in their millions as Mother Nature's resource base varies with the seasons.

About 300 years ago, Western society, first in England and then elsewhere, began to free itself from this dependence on annually renewable resources by helping itself to the stores of fossil fuel created by solar energy over millions of years

of prehistory. At first slowly, but then more and more rapidly, we have adjusted our energy demands upward until at the present time our per capita energy demand is around 8000 watts per person - a factor of 15 to 20 greater than that available to the third world. It is this factor of 15 in available energy that makes possible our affluent life style, that enables us to believe the myth that we are somehow more intelligent than the people of the third world, and that allows us to use the very cheap labor of our machines to exploit them mercilessly as we buy their agricultural products cheap and sell them our manufactured goods dear.

Energy in North America today is far cheaper than it was fifty years ago, in real terms. Indeed, it has been so cheap that, until the Arab countries began to treat oil as a scarce commodity like gold, no one really considered the price of energy as a critical component in the cost of doing business. If, instead of measuring productivity in terms of output/man-hour, we start measuring productivity in terms of output/unit of energy input, we enter the upside down world of Alice in Wonderland. In this new world of energy values, the much vaunted efficiency of Western agriculture becomes the least efficient agriculture in the world, while the agriculture of West China with its intensive use of manpower and its concern that all the excretions of men and animals be returned to the fields becomes the most efficient. In saying this, I am by no means advocat-

ing the methods used by China with its 500 watt/capita energy budget. We have technological skills and a social structure that should enable us to maintain something like our present energy budget, while at the same time helping the third world to raise its energy budget to the point where its ever present obsession with basic survival disappears.

Because we have lived for over three hundred years in an escalating energy budget and in a growth economy, we find ourselves congenitally unable to conceive of good times unless there is a growth in the GNP, in the size of our takehome pay, or even in the budget of our local church. The scale of our extravagance in the use of energy is measured by the fact that the world has used as much energy in the last twenty-five years as it used in all of history up to 1945. And the growth rate which we Westerners have accepted as our divine right will, if maintained until the year 2005, require us to use as much energy by that date as mankind has used in all of history up to 1980. There are signs that we are beginning to accept that such a scenario is impossible. Indeed, a very promising sign for the future is the fact that Ontario Hydro now has excess generating capacity. Despite the outcry of some who have cast hydro in the role of a villianous corporation concerned only with profits, the fact of the matter is that our Public Utility has planned responsibly on the basis of the historic pattern of growth

which had governed Ontario since the beginning of the 20th century. The present excess of energy simply underlines the fact that forward planners are usually wrong. When we are told that an aggressive program in the development of solar energy and in the production of methanol from our forests could make Ontario free of its dependence on non-renewable resources by the year 2025, we are not being presented with an exercise in forward planning, but in wishful thinking. Unpalatable as it may seem to some of the more vocal pressure groups in our society, the weight of informed opinion is that we shall need further development of nuclear power, further exploitation of our fossil fuel reserves, serious initiatives toward the so called "soft energy" options and unremitting pressures toward conservation if we are to meet the energy needs of the 21st century without destroying the fabric of society.

The narrowness of the focus of the Nuclear debate has allowed many of us to forget that the Canadian problem is only part of a much greater world problem. Figure I presents in graphic form the distribution of the world's coal reserves, as published in the United Nations Statistical Year Book for 1972. Statistics of this sort are notoriously inaccurate because no one, least of all a mining company conscious of the bottom line, can afford to explore the detailed character of an untapped coal

bed it may not need for twenty years. Nevertheless, the figures in the 1972 chart are only a factor of two different from projections made sixty years earlier and the uncertainties in them are far less than in any of the models which propose to show how the world can rely in a major way on solar energy or any other of the new technologies within the next half century. The figures in this table refer to coal found in veins at least one foot thick and less than 400 yards below ground. There is far more coal in thinner veins but the energy cost of getting it out uses up most of the energy it can produce after it is mined. The reserves of coal and lignite in the USSR are 5500 billion tons and the others are proportional as shown in the figure. The only other really major coal resources are in the USA and China. This fact of life must cause any one with a sense of the role energy plays in the affairs of mankind to ponder the political implications of this distribution. Can any of us here realistically expect any of these three nations to deplete their resources to build up the per capita energy base of those with no coal? The case of the U.K. presents an interesting sidelight on history. It was only 200 years ago that British ships were delivering Welsh coal to the east coast of North America more cheaply than it could be mined in the Appalachians. When we look at England's present resource base, we see why England was the first industrial nation to develop nuclear power, with very inefficient and primitive reactors compared to our Candu.

Although small in total quantity, Canada has a significant coal resource in Alberta, British Columbia and Saskatchewan. In terms of our population, it is somewhat larger than that of the States. It is not surprising that since its uranium resources are small and its coal resources large, the B.C. government should respond to a pressure group to declare a moratorium on uranium mining. You will have noted that South America and Africa do not appear in the chart. The total resources of either of these continents is comparable to that of Canada.

Let us now look at oil resources. I have chosen to build this chart on the British Petroleum Review of 1974. These refer to production and consumption in that year and thus involve known numbers. To the right of the center line is shown the production of that year, with the Middle East producing just over 1000 millions of barrels, and the USA and the USSR roughly half that amount. The rest barely count on the world scale.

To the left of the center line I have shown the consumption for 1974. The two major users of oil were the USA and Western Europe with roughly 600 million barrels. The cross-hatched areas represent the difference in production and consumption -- exported or imported. Already in 1974 it was clear to any one who could read, or more important "listen", that we had a major political problem on our hands, with the Middle East exporting nearly all its oil and Europe importing almost all of its needs.

As soon as the United States production started to decline, as it has done in every year since 1973, the energy crisis was upon us--fueled on the one hand by the American refusal to conserve gasolene or heating oil and on the other hand by the realization on the part of the OPEC nations that it was foolish to sell oil at a price related to production costs when it really was black gold which could be exchanged for the yellow metal so beloved by mankind.

Canada is again in a fortunate position, since we have significant oil resources. Although production in Southern Alberta has already or soon will start to fall, the artic oil has given us a new lease on life. It cannot be cheap oil, like that of Saudi Arabia. While the cost of getting a barrel of oil out of the ground of Kuwait and delivering it to North America is around a dollar, the rest of the $30 per barrel cost being an artificial cost similar to that which one pays for an antique that you really want, the true cost of getting a barrel of oil from the Artic is probably around $16, and much of this dollar cost represents an energy expenditure. Neither oil nor coal will ever be exhausted. What will happen is that the energy needed to extract it from the ground will be so close to that which can be obtained from burning it that there is no point in the exercise. At that point in time, it won't matter if it is worth one dollar a barrel or a million.

Again, conspicuous by their absence are the countries of South America and Africa. We Canadians are doing our best to make the case of South America worse by buying their oil cheap and selling it back in the form of manufactured goods at a good profit. Europe is doing the same for the North Africans.

The resource base for uranium is more widely distributed, and is at present very imperfectly known since there was no market for uranium until World War II. The cross-hatched areas of the next chart show the distribution of reserves which can be profitably mined at $26 per kilogram (1974 values). The blank areas show the additional reserves that become available at a production cost of $40 per kilogram. The resource base becomes enormous when costs of $200 per kilogram are permitted -- and one is nowhere near the limit at which the energy produced approaches the energy costs of mining. The chart also shows the thorium resources. These are of little interest now but become as useful for energy production as uranium when breeder reactors become common. At this point in time, the energy derivable from a kilogram of uranium or thorium will be increased perhaps fifty times and the resource base becomes effectively infinite, many times the total energy derivable from fossil fuels.

In terms of uranium, North America is just about as dominant as the Middle East has been for oil. However, there are also major resources in Africa, in Europe and Australia. The USSR does not report its resources but they are estimated to be sig-

nificant. Again, India seems to have been seriously left out when Mother Nature distributed its largesse.

Some of you will be asking why I have taken so long over the resource base for coal, oil and uranium. The point is that these three are going to be the major sources of energy for mankind for the next century whether we like it or not. A lot of money is already being poured into research in alternate energy sources, probably almost as much as can be used effectively at the present time. Indeed, those who have spent their life in research in science and engineering, know that there is a long and painstaking road to be travelled between the generation of an idea and the creation of a system which can be used on a large engineering scale. I should like to quote from Foley who has written one of the most balanced accounts I have seen of the "Energy question".

I quote "Despite the efforts made over the past thirty or forty years, little real progress has been made in developing practical application of solar energy. Professor Hottel of MIT, one of the leading authorities on the subject commented in 1971 that during the 25 years when he was chairman of a committee in charge of allocating the income from a large endowment for solar energy research, the number of research centres increased from three to thirty-give and "the common pattern, with few exceptions, was repetition of older research and the addition of little that

was new and less that was economically significant." I have a son-in-law chemist in the solar energy business. In his opinion, the only use of solar energy that is cost effective today is for heating hot water -- for large office buildings -- or for extending the usuable period for swimming pools. He firmly believes that within a very short time, electrical heating of houses using nuclear power will be cheaper than oil or gas heating and that rather than using solar energy, heat pumps with electrical or oil heating as a backup and an intensive insulation program will be the cost effective ways of reducing energy demands over the next two decades.

It is unfortunate that in distributing her resources, Nature did not take into account the world's concentrations of population. Instead, She gave us in the West, an abundance of resources which we are squandering with little thought for tomorrow, while denying India and Africa the resources which would enable them to raise their energy base to a level where starvation could be avoided!

In 1960, I visited the Warsak project near Peshawar where Canadian expertise had been used to build an electrical generating station on the Kabul River and at the same time had trained Pakistani engineers in the art of dam building in which we Canadians have highly developed expertise. The electrical output from this one dam revolutionized the life style in thousands of villages and towns of West Pakistan by making electricity

available as a slave to operate their machines and raise their energy base. I don't think I have ever felt so proud of Canada as I did at that time. Not only had we used our Colombo plan funds to help Pakistan but we had done it in such a way as to decrease their reliance on us. This cannot be said to be true of many of our foreign aid projects which merely send abroad the surplus grain we cannot use or the manufactured goods that we cannot sell. In both cases, the main object is to maintain full employment here -- and any benefits that fall to the recipient are incidental.

It is frequently said that nuclear power is "unsuitable" for developing countries -- that what they need is small labor-intensive energy devices. Well, that is precisely what they have had for milennia. All they have known are the labor intensive energy devices that come in the 100 watt human size and each adult knows very well that unless more of them are made, old age without a large family around will be a desolate time of life. If Western experience can be used as a guide, overpopulation will begin to solve itself as the energy base rises to where large families are no longer an economic necessity.

They certainly do not need solar energy for heating, and their need for hot water is infinitesimal compared to ours. They already use all of their wastes -- that from the table is fed to a protein generator, more commonly known as a cow or pig, that from the latrine goes back on the land. They have almost no

firewood available, so their small cooking fires are nursed tenderly with twigs, with grass, with the lower branches pulled off the trees in the parks or with dried cow manure as our pioneer forefathers used buffalo chips. Of course it would be better to put the manure back on the land, but beggars cannot be choosers--and a cooked meal today is not to be traded for the promise of a better one in a year's time when the next crop comes in.

Of course, where there is fertile land and water, solar energy can give them an enormous advantage over the farmer in our more temperate climate. Sugar cane and jute can grow twelve feet tall in a few months and alcohol to fuel automobiles can be produced from sugar lands at present prices to compete with fossil fuel generated gasolene. Unfortunately, fuel produced in this way is literally taking food out of the mouths of the people. While gasohol may be a way of dealing with our affluence, it is no answer to the third world.

What the third world needs most of all is an injection of energy above the minimum necessary for marginal existence. What form that energy should be in should surely be their choice, not ours. Our attitude to the third world reminds me very sharply of our attitude toward the unemployed in the dirty thirties. In those good old days, conventional wisdom believed that no one who was out of work was to be trusted to handle money. Thus our relief system operated without cash, requiring each recipient

to appear weekly at a wicket to receive a made-up package of stale bread, beans and a few other staples chosen by the relief officer. In Hamilton, the callousness of the system was dramatically revealed when an elderly woman who was on relief and a client of the Family Service Agency was found dead in her single room. She had literally starved to death, with a year's supply of beans under her bed. She had no teeth to chew them and no money to pay for the heat to cook them. It took incidences like this to make Canadians realize that the only difference between a person on relief and one who was not was the fact that one had no work and the other had a job to do. We still find it impossible to realize that the basic difference between a citizen of the third world and a citizen of Canada is that the latter has an energy budget at least ten times that of the former. While in my prejudice I believe that my nine grandchildren are the brightest children in the world, honesty forces me to admit that had my wife and I been average citizens of Bangladesh, their prospects for an "abundant life" in the Christian sense would be almost non-existent.

I find it ethically unacceptable for us, in our affluence, to deny to the third world the assistance they so sorely need in raising their per capita energy base. The easiest and most effective way of distributing that energy is through electricity. And this electricity should be provided in whatever way the economics of the local scene suggests is best. By all means, let us help them develop their hydro electric capacity, as Canada has done at Warsak. By all means let us

help them develop geothermal sources or whatever others are suitable. But when nuclear power is the best option, as it will increasingly become, let us look at it clearly, recognizing that nuclear power is one of God's great gifts to mankind.

To say that they cannot handle such complicated power sources as reactors is an arrogance that we cannot condone. Very few of us in Canada can fix our own cars, let alone understand how a reactor works. The people of India, China and Africa are at least as practical and as teachable as we are.

Perhaps some of you may be saying that they might use their reactors to produce bombs which would come back to destroy us. A much more real danger is that our failure to redistribute the world's energy resources equitably will bring this whole world down in a holocaust--started by the nations which now have the capacity for nuclear war and which include among them the only nation which has dropped a nuclear bomb in anger . It is possible technically to show that power reactors make very poor sources of bomb grade plutonium and that the research reactor which Canada gave India was precisely of the style to make plutonium easily. However, these arguments are really beside the point. Nuclear power is a fact of life and must become increasingly so over the next century. Nuclear weapons are also a fact of life, which we all deplore. The connection between them is much less direct than the fear mongers among us would imply.

I had a new experience a few weeks ago acting as moderator in a debate at McMaster between a representative of Energy Probe and a young scientist from Atomic Energy of Canada. It was supposed to be a learning experience but it turned out to be far from that. What we saw played were beautiful games with words, skilfully used to play on one's natural fear of the unknown. It reminded me of a story. Once upon a time there was a King who had severe financial problems. Cholera came to him and said " I shall solve all your problems if you let me into your city. " The King, of course, demurred. But when Cholera promised that he would kill no more than 100 people, the King finally accepted the bargain. Cholera came in and 10,000 died. When the King accused Cholera of bad faith, Cholera replied, "I kept my promise -- I killed 100 people -- fear destroyed the rest".

If this world destroys itself, it will not be because we have truly shared nature's resources but because we witheld them in selfish fears for our own future.

To me the issue of nuclear power is really a non-issue. A thoughtful reading of the books, pamphlets and speeches of those opposed to nuclear power suggests that their primary concern is

to change our life style and that they are using nuclear power as a device to scare people into repentance. Their aim is a worthy one but it should be faced honestly--recognizing that every source of power, including the so-called soft technologies, carry with them their own risks and these risks are roughly proportional to the amount of energy being produced. The only energy sources that do not have associated risks are those that have not yet been discovered. That is one reason why fusion appears to be so attractive.

Because we are an energy-rich society, we must face special risks but let us not think that the energy starved societies of the third world are risk free. Our risks are measured in the almost hysterical concern over Three Mile Island which may have initiated perhaps 10 cancer cases over the next thirty years in a population where 350,000 cases from other causes will occur in that time period. Their risks are measured in deaths that occur now because there is no energy margin available when crops fail.

Our risks are measured in the occupational hazards of coal mining which kills at least ten times as many people as does uranium mining per megawatt-year of energy produced; theirs are measured in lives of unremitting toil which prematurely ages men and women so that the vitality of our sixty year olds match their thirty year olds.

Our risks are measured by our fears of nuclear war, of carcingens in our foods, of environmental damage; theirs are

measured by their fear of the money lender which can force them off the land into starvation if the spring rains do not come.

Two years ago, I was much less convinced of the fundamental integrity of the Canadian nuclear power program than I am today. The risks of environmental damage associated with nuclear power are far lower than fossil fuels; even wood burning has its dangers as the rising incidence of household fires clearly demonstrates.

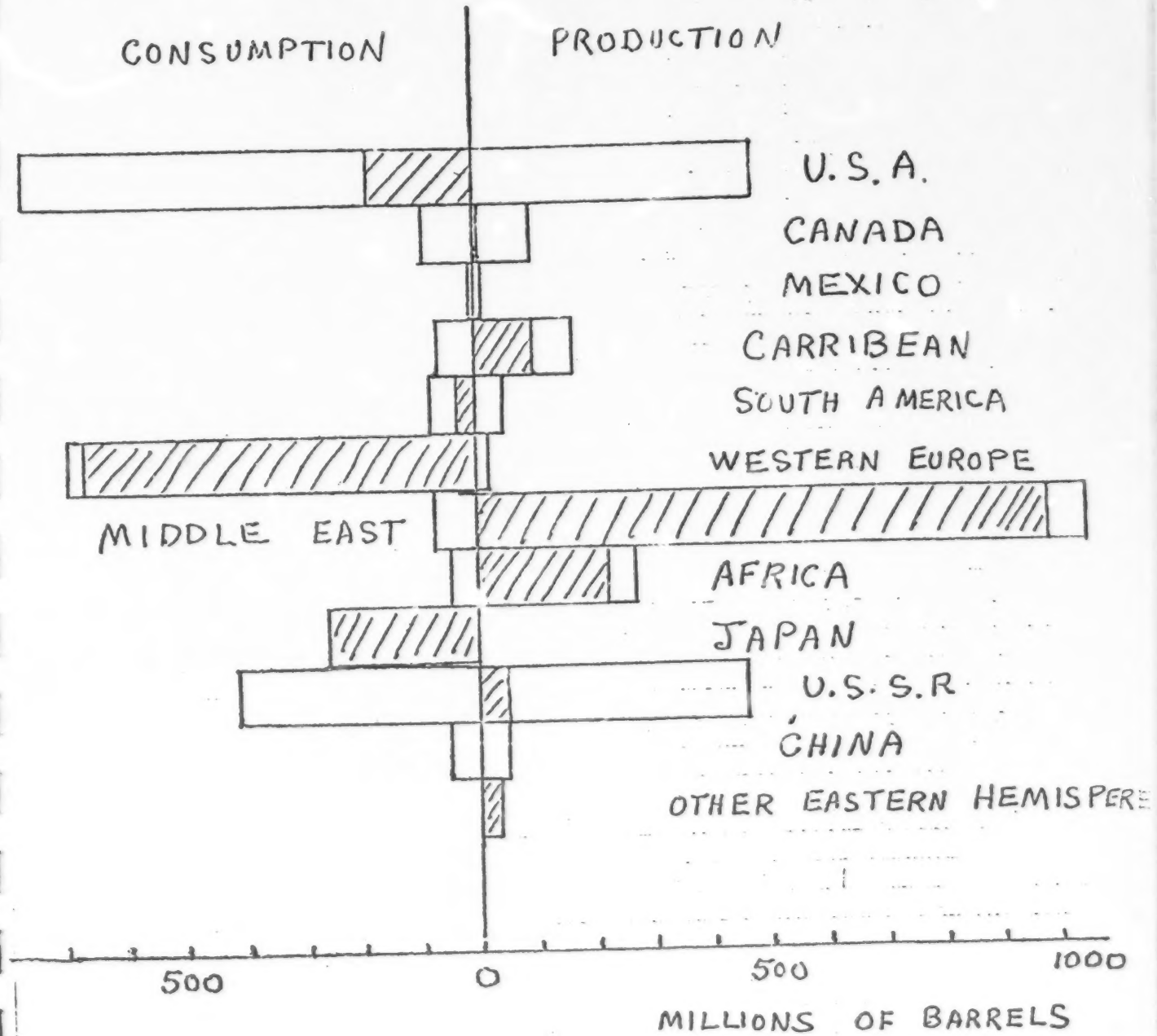
The waste disposal issue has to me always been a red-herring. Judged purely on economic grounds, it would be wasteful to bury nuclear wastes underground since they carry within them a resource we shall need in the future. The concern for the safety of generations yet unborn has been exaggerated out of all recognition by the fact that people do not understand that a long-lived radioactive species is by its very nature not very radioactive. The disposal of wastes is going to be an increasingly complex political matter for any big city--and fossil fuel wastes and garbage may soon become as hard to dispose of as nuclear wastes. Madoc really lost a chance to have a clean industry when the citizens were stirred up to oppose AECL's plans to bury nuclear waste in their area. However, such is fear!

The Candu system which is the result of forty years of research on what was seen in 1940 recognized as the most efficient way of extracting energy from Natural uranium is now beginning to catch the eye of the world. Of course, there will be

shutdowns from time to time as there are with all power plants (hydro, fossil fuel, tidal,geothermal) but I expect Pickering and its daughters to continue to give us a secure energy base for a long time to come and to keep the skies over Ontario far bluer than they will be in the States which is making an all out attack on its coal reserves.

Candu can help the third world and we should be proud to allow it to do so.

WORLD OIL PRODUCTION AND CONSUMPTION, 1974*



*British Petroleum Statistical Review, 1974

WORLD COAL RESERVES

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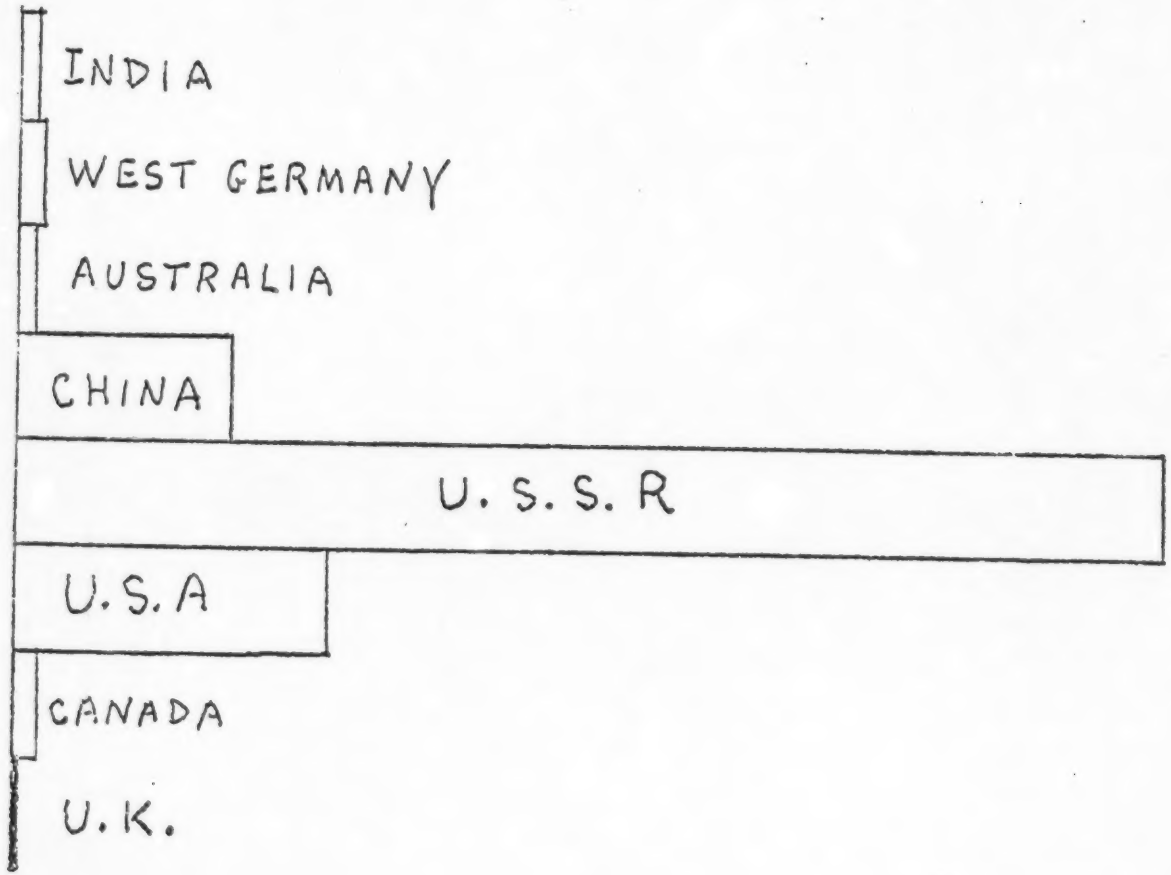

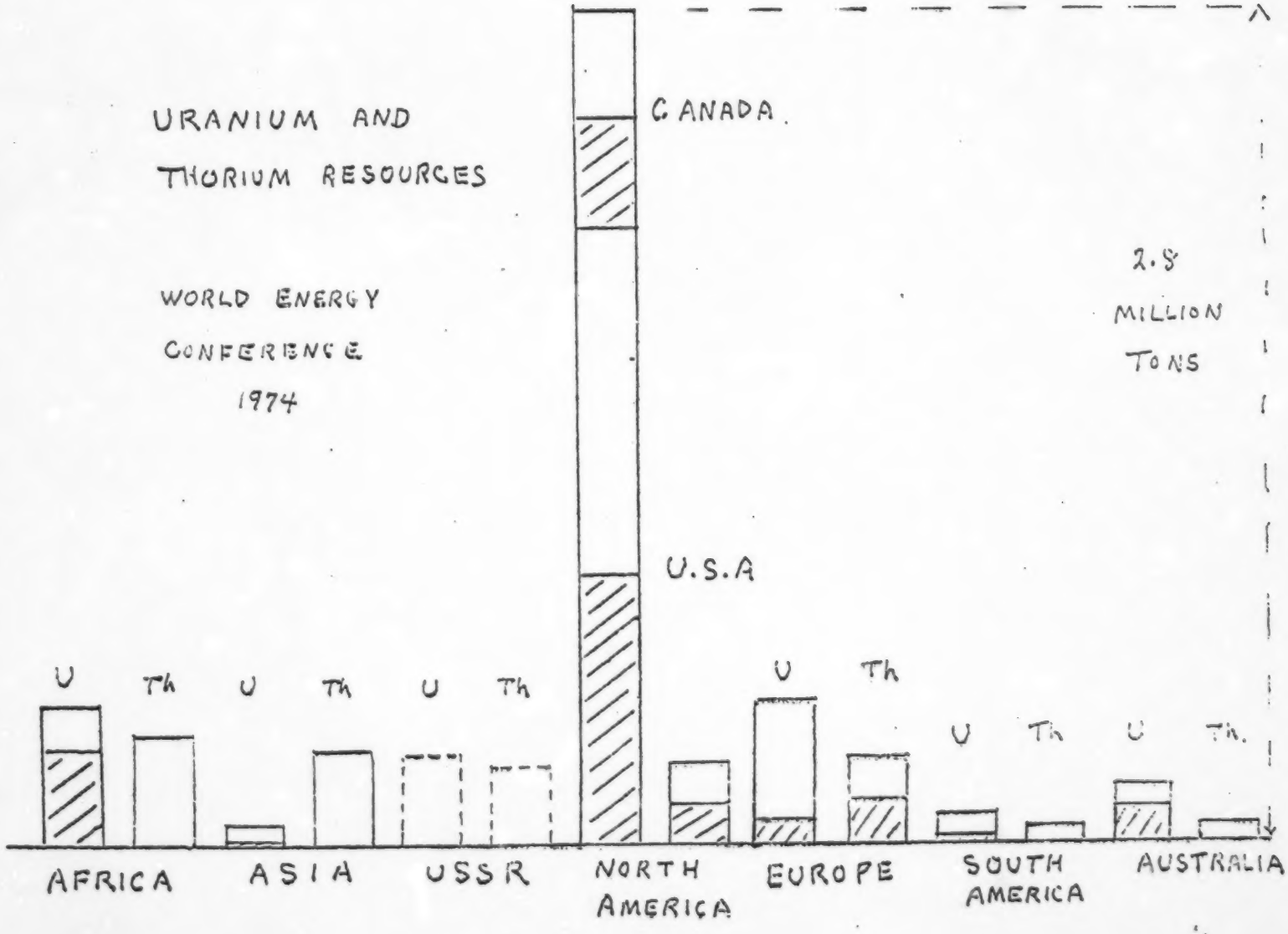
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Chairman's Closing Remarks - Dr. D. Hitchcock

Thank you, Martin.

It's my function at this time to give you a coherent summary in ten minutes of everything that has gone on during this seminar. Since that is impossible, I shall confine myself to making a few remarks to highlight some of the themes and perhaps draw some threads together, certainly not all of them.

As a philosopher who has had very little background in the details of nuclear energy, I've been very impressed in my work in preparation for this conference and at the conference itself with the willingness of a group of people like yourselves in the Canadian Nuclear Association to expose yourselves to different ways of thinking and trying to see how the technical aspects interface with some of the questions of principle and ethical considerations which your spokesmen have been confronted with in various kinds of hearings and debates. This is a commendable exercise and innovation on your part, and I might add that it's the sort of thing which is appropriate not only in the field of nuclear power but in all sorts of areas of human endeavour.

What this seminar has shown, and Dr. Lynch's remarks have amplified this theme, is that it is a very difficult matter to bring the kinds of abstract questions of principle, of conceptual clarification and of definition with which philosophers concern themselves together with the detailed questions of what policy ought to be, with regard to the development of an energy policy and with regard to the development of nuclear power - to merge the technical considerations with the ethical considerations.

On the one hand, there is a lot of work to be done by those of us who have a philosophical or theological background in making ourselves better aquainted with the facts, with the issues that

arise out of the way the facts are, because there's a great tendency to talk about questions that turn out not to be real questions when you come to look at the facts.

On the other hand, there's a need, in thinking about technical questions, to see that, when policy decisions are being made related to technical questions, there are implicit assumptions and to have some facility in recognizing these and being able to think them through systematically.

Some of these assumptions have come out in various discussions and talks today and last night. I would like to go back to the mythical bases which George Pickering talked about at the end of his talk last night, the Promethean impulse of technology to control nature and the impulse in our religious heritage from Sinai and Calvary to seek justice between men. The question posed was: How do we merge these? How can these two aspects of our faith as a people be reconciled? And of course I emphasize again that this applies not only to nuclear power but to a whole host of other fields of current endeavour, as well.

Dr. Najm in his talk on technology has given us a sense of an internal self-limiting character of the Promethean impulse. The constitutive function of technology to make man more in control imposes limits on how far technology can go. When it becomes a master rather than a slave it has gone beyond those limits. So there is a limitation on technology, the technological imperative, as he called it. The utility function of technology relates to some of the questions of justice which arise out of the other aspect of our faith, going back to Sinai and Calvary. It's a question not only of the amount of benefits that come from a given technology, but also of how those benefits and costs are going to be distributed.

Rev. Hamel in his talk this morning gave us some principles for an ecologically just society which we'd do well to keep in mind and which tie into a number of other things said, by various people.

The notion of an energy policy which is sustainable in the long run is a policy which takes into account our obligations to future generations. And it does view us as having very definite and serious obligations to future generations, perhaps equal to these we have to the current one. It's perhaps a measure of our ethical progress as a society that we're beginning to think seriously about the impact of what we do now on successive generations in a way that we have not done in the past.

The criterion of equity, which Peter Hamel mentioned, ties in with the principle that Andy Brook developed in his paper on Uranium Mine Tailings and our Obligations to Future Generations, and that is the equal worth of all individuals. The fact that it is me rather than you does not in itself have any moral weight. As an individual each person is of equal worth. If we listen to what Peter Hamel said about the native peoples and listen to what Martin Johns has just finished saying about the people of the third world, this principle of equal worth gives us very substantial ethical directions for the development of energy policy, including nuclear energy policy.

Thirdly, the ideal of 'participation' which Peter Hamel mentioned, the notion that each person is entitled to some kind of input into the decision-making that goes on in his society seems to me to be a consequence of almost any of the fundamental ethical positions that were put forward for our consideration at one point or another - whether it's the principle of the equal worth of individuals; whether it's the kind of ideal contract theory that Jan Narveson developed this morning; whether it's the doctrine of utilitarianism, or some kind of variant of it. This is so, because control over things that fundamentally affect

an individual is a very important benefit, a very important good to an individual and it is not something which in making an ideal contract an individual would very willingly give up.

Although there may not be a neat package of conclusions from all the things which have been said during this seminar, there is a great deal of coherence and a great deal of consistency and a great deal of food for reflection.

I'd like to congratulate the Canadian Nuclear Association for holding this seminar and thank you for attending.

Appendix A: Preliminary List of Participants

SEMINAR ON MORAL AND ETHICAL ISSUES RELATING TO

NUCLEAR ENERGY GENERATION

D.E. ANDERSON
ONTARIO HYDRO

D.G. ANDREWS
U OF T

MARIA BARRADOS
AECL

M.J. BASTIANI
DENISON MINES

JIM BEDORE
URANIUM INST. OF LONDON

T.A. BOX
ANGLICAN CHURCH

LOIS BOYCE
UNITED CHURCH OF CANADA

F.C. BOYD
AECB

G.C. BROWN
WESTINGHOUSE CANADA

PETER BROWN
CANATOM INC.

A.R. BURGE
AECL

ROBIN CHARLWOOD
KLOHN LEONOFF

JOHN COADY
AECB

P.A. COMTESSE
SULZER BROS.

CYNTHIA COULTER
AECL

C.G. CRAIK
CANATOM INC.

A.R. DASTUR
AECL

J.E.O. DAVIES
ONTARIO HYDRO

JACK DAVIS
MINISTRY OF EDUCATION

H.R. DEBNAM
WESTINGHOUSE CANADA

M. DESROCHERS
NUCLEOTEC

J.T. DUNN
AECL

ROGER DUTTON
AECL

RUSS EATON
SASK. MINING DEVELOP. CORP.

WERNER FIEGUTH
GELLMAN, HAYWARD & PARTNERS

RALPH W. GILBERT
SASK. MINING DVLOP. CORP.

A.J.U. GRANGE
ONTARIO HYDRO

EARL GRAY
WRITER

I.A. GRIEVE
AECL

REV. HARVEY
UNITED CHURCH

ROBERT H. HAY
KINGSTON PUC

JOHN HEWITT
U OF T

WALTER HIBBINS
STANDARD MODERN TOOL

ELGIN HORTON
ONTARIO HYDRO

F.H. HUESTON
ELDORADO NUCLEAR

T.A. HUNTER
CGE

R. JEPPESON
ONTARIO HYDRO

R.E. JERVIS
U OF T

KEN JONES
STANDARD MODERN TOOL

K. JOHANSEN
ONTARIO HYDRO

K. KRENZ
NATIONAL RESEARCH COUNCIL

I.E.B. LAUCHLAN
ONTARIO HYDRO

G.T. LEAIST
ENERGY, MINES & RESOURCES

D. LEEMANS
ONTARIO HYDRO

PAUL LEGER
ELDORADO NUCLEAR

JOHN A. MACPHERSON
AECL

J.R. McCLEMENT
SASK. POWER CORP.

H.J. McNEILL
SASK. MINING DVLOP. CORP.

J. McPHEE
SASK. MINING DVLOP. CORP.

P.R. MATTHEW
B.C. MINING ASSOC.

MS. M. MURRAY
SASK. MINING DVLOP. CORP.

D.E. NUTTER
PAN OCEAN OIL LTD.

B.C. PATTINSON
CDN. SOCIETY FOR PROF. ENG.

E.C. PERRYMAN
AECL

J.C. POWER
AECB

R.P. RICHES
ONTARIO HYDRO

J.T. SAMPLE
TRIUMF UBC

L.C. SECORD
DSMA ATCON LIMITED

R. SERGE
HYDRO QUEBEC

D. SCHMEICHEL
SASK. MINING DVLOP. CORP.

W. SHAW
CGE

J. SHEWCHUK
ONTARIO HYDRO

SUE STICKLEY
ONTARIO HYDRO

E. SIDDALL
AECL

DR. C. SIMPSON
ONTARIO HYDRO

H.J. SISSONS
ONTARIO HYDRO

W.D. SMYTHE
AECB

G.E. STOKELL
RESOURCES DEVELOP. SECRETARIA

M. TABOURET
AMOK LIMITED

BOB TAYLOR
ONTARIO HYDRO

M.M. THERRIEN
NUCLEOTEC

DR. T.S. THOMPSON
N.B. ELEC. POWER COMM.

D.E. TOUGH
WESTINGHOUSE

D.A. WATSON
ONTARIO HYDRO

A.C. WHITTIER
AECL

ALAN WYATT
MONTREAL ENG.

K. WADSWORTH
NORCEN ENERGY RESOURCES

A.M. YU
ONTARIO HYDRO

GUESTS

FATHER DAN DONOVAN, Roman Catholic Priest,
Associate Professor of Systematic Theology
at St. Micheals College, Univ. of Toronto

PROFESSOR FARRIS, Presbyterian Minister,
Senior Faculty Member at Knox College,
Univ. of Toronto

Canadian Nuclear Association Association Nucléaire Canadienne
Suite 1120, 65 Queen St. W., Toronto, Ont. M5H 2M5 Tel. 363-6433 Telex 06-23741 Cables. Canuca

SEMINAR ON
MORAL AND ETHICAL ISSUES
RELATING TO
NUCLEAR ENERGY GENERATION

Ontario Science Centre

Thursday, March 13, 1980

With opening dinner session on Wednesday, March 12, 1980
at the Inn-on-the-Park

SEMINAR ON MORAL AND ETHICAL ISSUES

SPONSORED BY THE CANADIAN NUCLEAR ASSOCIATION

Why a seminar of this type ?

Recent commissions of inquiry as well as annual meetings of church groups have revealed a growing interest in the moral and ethical issues associated with the development and use of nuclear energy. At the same time, many people, including members of the Canadian Nuclear Association,may not have a clear understanding of the issues or be able to assess the moral and ethical implications in a systematic manner.

It is a major objective of the seminar to increase the quantity and quality of information available on the subject and to expand the awareness of the members of the Canadian Nuclear Association and the public on these important issues.

Seminar attendance.

The facilities to be used at the Ontario Science Centre can accommodate a limit of 100 persons. Of this number 80 places will be made available to representatives of CNA member organizations on a first-come first-served basis. The remaining places will be occupied by selected invited guests and seminar speakers.

Registration fees.

Registration fees prior to February 29th, 1980 will be $85.00 and $95.00 thereafter. This fee will include the dinner on March 12th, luncheon on March 13th at the Science Centre as well as papers presented at the seminar. Delegates will not need to pay admission to the Science Centre but should wear Seminar registration badges upon entry to the building.

Make cheques payable to:"CNA Ethics Seminar" and mail to:

CANADIAN NUCLEAR ASSOCIATION
65 Queen St.W., Suite 1120
Toronto, Ontario M5H 2M5

The registration desk will be open from 4:30 p.m. to 7:30 p.m. on March 12th at the Inn-on-the-Park.

Hotel Accommodation

Please make your own reservations with the Inn-on-the-Park, 1100 Eglinton Ave. East, Toronto, Ont.
Tel: (416) 444-2569 .

6.0 Agenda

Wednesday, March 12, 1980	Inn-on-the-Park, 1100 Eglinton Avenue East, Toronto, Ontario
5:00 -6:30 p.m.	Cash Bar
6:30 -7:30 p.m.	Dinner - Oak Room
7:45 -9:30 p.m.	Opening Remarks Mr. W. MacOwan, Chairman of the Board Canadian Nuclear Association Introductory Address "An Analysis: Social and Ethical Issues in Energy Use" Dr. G. Pickering University of Detroit Moderator Dr. D. Hitchcock McMaster University
Thursday, March 13, 1980	Theatre B (Blue), Ontario Science Centre, 700 Don Mills Road, Toronto, Ontario
9:00 -10:30 a.m.	Morning Address "Ethical Theory: What it is, and Why it Matters" Professor J. Narveson University of Waterloo
10:30 -12:00 noon	Presentation of Papers 1. "Uranium Mine Tailings and Obligations to Future Generations" Dr. J.A. Brook Carleton University 2. "Theological Questions of Justice: Social and Environmental Issues" Rev. P. Hamel Anglican Church of Canada 3. "Nuclear Power in Developing Countries" Dr. R. Morrison Carleton University
12:00 - 1:00 p.m.	Lunch

1:00 - 2:30 p.m.

Workshops

1. Obligations to Future Generations

Do we have any? If so, should the interests of people in future generations be counted as equal, or inferior to the interests of people now living ? (A fundamental ethical consideration in the long-term storage of nuclear waste materials.)

Resource Person:

Mr. R.J. Gaizauskas
Carleton University

2. Theological Considerations

What responsibility for nature does man have independently of his obligations to fellow human beings? (An issue commonly raised by church groups with broad implications for evaluating environmental effects.)

Resource Person:

Dr. D. Jay
Toronto School of Theology

3. Risk Assessment

What is a reasonable model for deciding whether the risks of a given course of action are acceptable ? The fundamental ethical question is deciding whether the risks of radiation-induced fatalities in normal operation of nuclear reactors, in possible accidents and in long-term nuclear waste storage are worth the benefits of nuclear energy.

Resource Person:

Dr. T. Rogers
Carleton University

4. The Technological Fix

   Is reliance on high technology industry contrary to social and political ideals? (A question answered in the affirmative by advocates of "soft energy paths" as an alternative to the "hard energy path" of nuclear energy.)

Resource Person:

Dr. L. Shemilt
McMaster University

3:00 - 4:30 p.m. Presentation of Papers

1. "Technology and Its Human Implications"
   Dr. S. Najm,
   McMaster University

2. "Bioethics, Public Ethics and Environmental Ethics Defined and Clarified"
   Dr. A. Lynch,
   University of Toronto

3. "Energy as a World Problem"
   Dr. M. Johns
   McMaster University

4:30 - 4:45 p.m. Concluding Remarks

Appendix C

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